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**RECORDS OF DAIRY COWS: THEIR VALUE AND IMPORTANCE IN ECONOMIC MILK PRODUCTION.<sup>a</sup>**

By CLARENCE B. LANE, B. S.,  
*Assistant Chief of the Dairy Division, Bureau of Animal Industry.*

INTRODUCTORY.

The condition of the farming industry as seen on the average farm points to the need of better business methods and more definite knowledge of the sources of profit and loss. In no department connected with the farm is there more need for absolute data than in the dairy. The records of progressive and unprogressive dairymen indicate that there is no business which shows a greater range of profit than that of dairy farming. Investigations of creamery patrons illustrate this most strikingly and show that one dairyman frequently makes double the profits of his neighbors. In an investigation of the records of 100 creamery patrons, conducted by Hoard's Dairyman, it was shown that one of them made \$2.30 for every dollar invested in feed for his cows, while a neighbor made \$1, and another lost 50 cents. All had the same soil and the same market. Not one in ten read any dairy literature, and thirty-eight out of the hundred kept cows at an actual loss. The difference in their profits, therefore, must be accounted for largely by the difference in the intelligence put into their business. Such a wide range of profit rarely exists in other kinds of business. Good judges believe that one-fourth of the cows in the entire country kept for milk do not pay for the cost of keeping, and nearly one-fourth more fail to yield an annual profit.

The objects in view in the preparation of this article are, first, to show dairymen the importance of keeping records complete enough to give the dairy performance of every cow in the herd, thereby making it possible to weed out the unprofitable animals; second, to induce dairymen to keep records, not only for the additional profits, but for

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<sup>a</sup> Reprinted from Twenty-second Annual Report, Bureau of Animal Industry (1905). This paper is largely an abstract of Bulletin No. 75 of this Bureau, "Records of Dairy Cows in the United States." In that bulletin were published more than 12,000 milk and butter records of herds and individual cows, including records made at the Columbian Exposition, Chicago, 1893, the Pan-American Exposition, Buffalo, 1901, and the Louisiana Purchase Exposition, St. Louis, 1904. Readers who desire a more complete compilation of such records than is given in the present paper are referred to that bulletin.

the increased interest which they give to all connected with the work and the business methods which they have a tendency to promote; and, third, to show the possibilities of production with different grades and breeds of cows under different conditions, thereby giving encouragement to the farmer and an incentive to higher standards and greater profits.

With the application of the scales and the Babcock test, combined with better care and feed, both the production and the profits of many herds could be doubled, and this with little expense.

#### VALUE OF DAIRY RECORDS.

Records of the performances of dairy cows form the only accurate and safe basis for judging their value. It is the constant aim of progressive dairymen to improve their herds, and such improvement must depend largely upon culling the herd and getting rid of the unprofitable animals. From the breeders' standpoint records are especially valuable in assisting in finding customers for their stock. Many buyers insist on seeing records of dairy performance before purchasing.

A record is also of great help to the feeder. If he knows exactly what a cow is doing, he can prepare the ration accordingly and often feed more economically. Again, a daily milk record enables a dairyman to detect the approach of sickness in a cow, and thus to take steps to ward it off.

Great inspiration is obtained from keeping a record, and nothing gives a dairyman more satisfaction than watching the improved returns from his herd.

Many of the State experiment stations have shown the importance of keeping careful records of the individual cows, and thus determining which are profitable and which are kept at a loss. At the Georgia station the best cow in the herd gave 7,968 pounds of milk, which produced butter worth \$115.44, while the poorest cow in the same herd gave only 2,788 pounds of milk, with a butter value of only \$41.63. At the Michigan station the profit on the milk from different cows varied from \$6.08 to \$94.05. At the New Jersey station the profits from different cows varied from 13 cents to \$49.72 when milk was valued at \$1 a hundred pounds. At the Connecticut (Storrs) station during the year 1903 the best cow gave a profit of \$54.72 and the poorest \$2.76. In this case the best cow gave a profit of nearly twice that of the average cow in the herd. At the World's Columbian Exposition, Chicago, the cow with the best individual record made two and one-third times as much butter as the poorest of the seventy-five.

While the differences between the best and poorest animals in the cases given are great, the poorest cows reported are not so poor as

many of those kept by dairymen who make no accurate tests and who rarely know anything of what each animal is actually doing.

The Illinois Experiment Station, after testing a number of herds in that State, comments as follows:

Nearly every herd we have tested has proved that some of the cows produce butter enough to pay a handsome profit to the owner, while others that require the same feed, care, and time spent in milking do not make butter enough to pay for the feed they eat. \* \* \* One man who kept twelve cows got more money for the milk of three of them than he did for that of all the other nine put together.



FIG. 1.—Scales, record sheet, and samples conveniently arranged.

#### ACCURATE RECORDS NECESSARY.

In a general way the farmers know the good milkers in their herd, and in the same general way they weed out those that are considered inferior; but only a few breeders, whether of common or purebred stock, use the scales or the fat test to supply definite knowledge. When the milk is not weighed the amount is almost sure to be overestimated. The fact that a cow gives 12 to 15 quarts of milk in a day at a certain time does not prove that she will give 5,000 pounds in a year. The cow must be fed and cared for during the entire twelve months, and the profit or loss depends on what she will produce during the entire year.

The record of the herd is a matter of the utmost importance. The highest degree of success can not be attained unless dairymen know the productive capacity of each individual cow. This is necessary as a guide to rational treatment and to insure the greatest profit. The record should include not only the dairy performance but a concise history and description of each animal. The former requires a

daily record of the milk yield of every cow and a fat test of several consecutive milkings, if accurate records are to be secured. Samples for this test may be mixed and this "composite sample" tested, thus obtaining the average. The method is easily learned and practiced. With the percentage of fat taken periodically and a summary of the daily yield of milk, the dairyman has a full record of every cow in his herd. To give still more complete knowledge there should also be a record, at least approximately accurate, showing the cost of the feed consumed by each cow, so that the economy of production may be shown.

#### THE KEEPING OF RECORDS.

Records are far more easily kept than is generally supposed, and the time and cost of keeping them for each cow is so small as to be only a trifle in comparison with their value. The length

of time required to weigh and sample the milk will depend much upon the quickness of the individual doing the work. After studying the question the Illinois station found that it required on an average one minute to each cow, or two minutes a day, and that when milk is weighed and tested every seventh week, as is customary with some dairymen, about one hour and thirty-eight minutes is

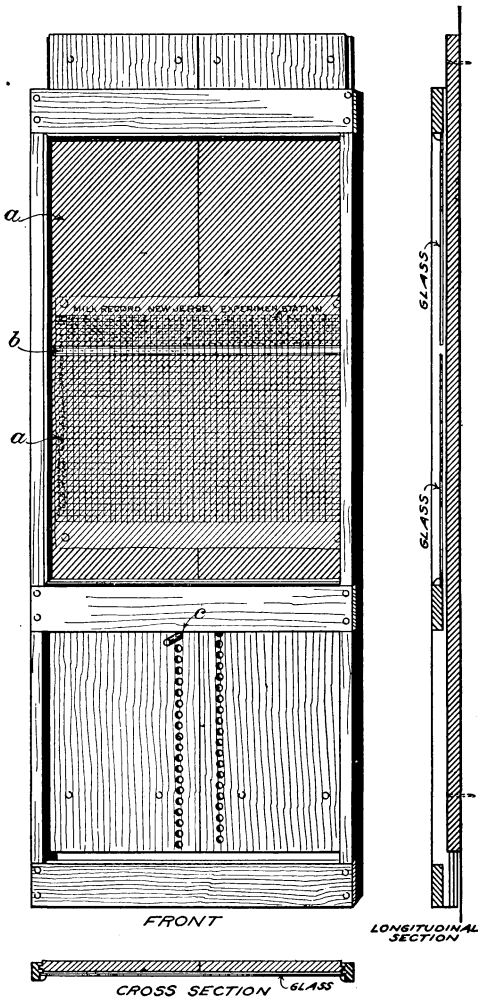


FIG. 2.—Adjustable record board used at the New Jersey Experiment Station.

required yearly for each cow tested. With this amount of time expended the farmer can have a reasonably accurate dairy record of every cow in his herd. Considering the time consumed in doing this work and the small expense involved in securing record sheets, scales, and some simple form of the Babcock tester, it is surprising that more dairymen do not test their herds.

Figure 1 shows the apparatus suggested by the Illinois Experiment Station for use by dairymen in keeping records. It includes scales, record sheet, and sample bottles, all conveniently arranged so as to take as little time as possible.

The following is a sample of a farmer's milk record as kept in accordance with the suggestions of the Illinois station:

*Sample of farmer's milk record for one week, from July 30, p. m., to August 6, a. m.*

Number of milking.	Yield of milk.										
	Spotty No. 1.	Black No. 1.	Black No. 2.	Bottle.	Milly.	Little Lamie.	Alice.	Belle.	Sleepy Eye.	Roan-ey.	Pet.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	20.5	14.1	11.3	15.0	15.4	10.9	6.9	7.4	7.5	5.5	15.1
2.....	13.5	6.8	6.5	10.2	13.2	8.3	5.2	3.9	5.1	3.9	10.3
3.....	22.2	16.8	11.7	15.0	17.0	11.0	6.7	7.9	7.7	5.2	15.8
4.....	14.2	5.2	8.2	10.7	14.2	8.5	5.2	4.9	4.6	3.9	10.9
5.....	20.3	15.7	6.0	13.7	16.3	10.7	6.8	6.5	7.3	4.9	15.7
6.....	16.7	7.0	9.2	11.9	15.6	9.5	5.1	5.1	6.1	4.6	12.2
7.....	18.5	15.5	4.7	14.1	16.7	9.6	7.0	6.0	6.6	5.0	14.5
8.....	16.0	7.8	7.3	11.2	14.4	8.7	5.0	4.9	6.2	3.9	14.7
9.....	22.0	14.5	13.5	16.4	18.5	10.7	6.9	7.2	6.9	5.3	15.8
10.....	14.0	9.5	6.9	10.5	15.0	8.3	4.8	4.6	5.3	3.6	11.4
11.....	19.9	9.8	4.0	12.9	17.5	11.0	6.7	6.1	7.0	5.2	14.9
12.....	14.5	13.0	6.8	11.5	14.5	8.1	4.4	4.6	5.8	3.9	11.3
13.....	22.6	13.2	6.7	16.1	18.4	11.6	8.6	7.4	7.3	7.8	16.1
14.....	15.4	7.1	8.8	11.3	14.7	8.6	4.3	5.2	5.9	4.2	11.7
Total.....	250.3	156.0	111.6	180.5	221.4	135.5	83.6	81.7	89.3	66.9*	190.4
Fat, per cent.....	3.2	2.8	3.2	3.5	3.2	3.4	4.6	4.0	4.6	4.4	3.0
Fat, pounds.....	8.00	4.36	3.57	6.31	7.08	4.60	3.84	3.26	4.10	2.94	5.71

The accompanying cut (fig. 2) represents a record board used at the New Jersey Experiment Station. A record sheet of sufficient size to include the weight of the morning and evening milk of each cow in the herd for a month is attached to this board by means of thumb tacks. Two panes of glass (*a, a*) are set in the frame in front of the record sheet with a space (*b*) of three-fourths of an inch between them for entering the record. The record board is so constructed that the front frame can be lowered each day to enter the new record by adjusting the pin (*c*) which holds it in place. It has the advantage of keeping the record sheet clean and in condition for permanent filing. The glass can be readily cleaned with a moist sponge.

#### THE BABCOCK TEST.

While full directions usually accompany the apparatus as purchased, it will not be out of place to state briefly here the principles of the test and how it is operated. The outfit (fig. 3) consists of a pipette for measuring the milk sample, an acid measure, test bottles grad-

uated to 10 per cent, and a centrifugal machine for whirling the bottles and contents at high speed. Small machines are easily operated by hand, while large ones require power.

The important thing at the outset is to secure a fair sample of the milk to be tested. This is accomplished by thoroughly mixing the milk by repeatedly pouring it from one vessel to another. It is then in condition to sample. The sampling may be done by using a small dipper. Owing to variations in the composition of the milk from day to day and in the morning's and evening's milk of the same day, it is necessary to collect several samples if accurate results are to be secured. These may be brought together for two or three days and made into a composite sample before the test is made. A few drops of formalin or a little potassium bichromate may be used to keep the sample sweet. The composite sample thus obtained should be thoroughly

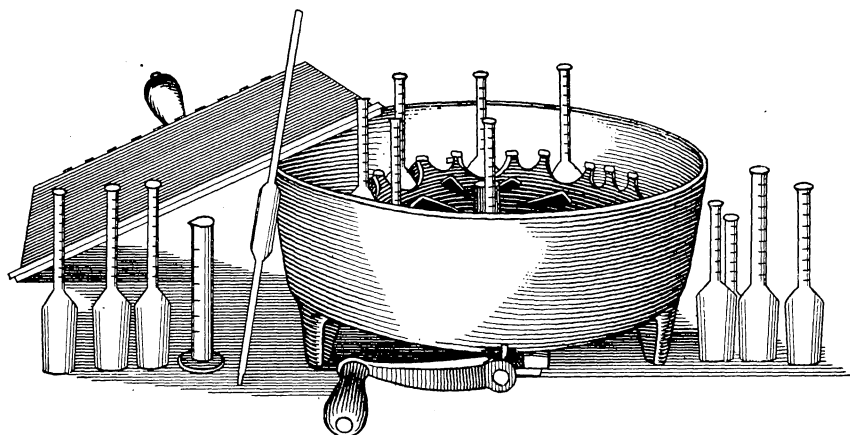


FIG. 3.—Apparatus for the Babcock test.

mixed. The pipette is then drawn nearly full of milk by placing the mouth at the end; the forefinger is then quickly placed over the top end of the pipette as it is removed from the mouth; the pipette is held on a level with the eye, while the milk is allowed to run out slowly until its surface is even with the 17.6 mark. The pipette is then inserted far enough into the test tube to allow the milk to run in without spilling. After the pipette has drained, the last drop is blown from it and the sample is ready for the acid.

The ordinary commercial sulphuric acid, having a specific gravity of about 1.82, is used in making the test. It should be used at a temperature ranging from 50° to 70° F. and always kept in a tightly stoppered bottle. Care must be taken in mixing the acid with the milk; 17.5 c. c. are measured into the acid graduate and slowly turned into the test tube in such a way that it runs down on the inside of the bottle rather than directly into the milk, to prevent burning the milk solids.

A complete mixture is effected by holding the bottle by the neck and giving it a gentle rotary motion. The action of the acid causes a rapid increase in temperature, at the same time dissolving all the nonfatty solids of the milk and making possible a rapid and complete separation of the fats.

The test bottles and contents are now placed in the centrifugal machine and whirled at the required speed, which varies with the size of the machine. The bottles assume a horizontal position, and as the fats are the lighter part of the milk they rise to the surface. With the hand machine full speed should be maintained for five or six minutes for the first whirling, after which enough hot water should be added to the contents of the bottles to float the fat within the limits of the graduated scale on the neck of the test bottle. The bottles are whirled again for two or three minutes at full speed, after which they should be placed in hot water (temperature 125° to 140° F.) to keep the fat in a clear liquid state for reading. If when managed in this way clots of curd or other matter are mingled with the fat, making the reading uncertain, the difficulty can usually be avoided by adding the hot water in two portions, filling the bottles at first only to the neck, and after whirling about one minute adding sufficient hot water to bring the fat into the graduated neck, after which the bottle should be whirled and the fat measured.

If a steam-power machine is used it will not be necessary to place the bottles in hot water.

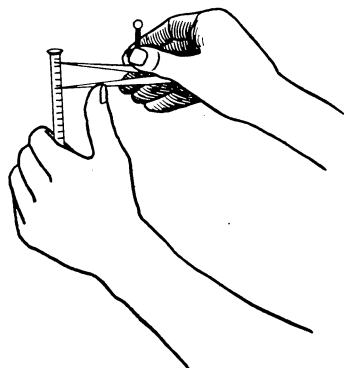


FIG. 4.—Reading the fat column in the Babcock test.

The percentage of fat is determined by the graduated scale on the test tube. A pair of dividers or small compasses (fig. 4) can be used to good advantage in reading the results. The two points are carefully adjusted, so they exactly inclose the fat column. The lower point is then placed at the zero mark; the other point will then indicate the exact reading.

The result obtained gives the percentage of butter fat in the milk. To determine how many pounds of butter a cow is producing, multiply the pounds of milk produced by the percentage of butter fat, and multiply the result by  $1\frac{1}{4}$ .

Example: 24 (pounds milk)  $\times$  0.04 (per cent fat) = 0.96 (pound fat)  $\times$   $1\frac{1}{4}$  = 1.12 (pounds butter).



Several methods of estimating yearly records from a few weighings and tests have been proposed. As previously stated, however, the only absolutely accurate way to tell the amount of milk and butter fat produced by a cow is to weigh and test the milk at every milking. Cows vary so much in the amount and quality of their milk from one milking to another that entirely accurate results can not be secured by weighing and testing the milk secured at a few milkings and using the results as a basis for estimating the total production for a lactation period, or even for a month. Many dairy-men, however, do not feel that they can take the time to secure daily records; nor is this necessary if it is simply desired to obtain a reasonably accurate estimate of a cow's performance at the end of the year. An approximate record is sufficient for comparing one cow with another or for determining whether a cow is up to the profit standard.

The Wisconsin Experiment Station recommends weighing and sampling the milk one day each week during the year. From these different weights and tests the amount of milk and butter fat each cow produces is estimated.

The Illinois Experiment Station suggests weighing and sampling each cow's milk for fourteen consecutive milkings every seventh week. These weights are added and multiplied by the average percentage of butter fat, the result being the number of pounds of butter fat produced. From these results the amount of milk and butter fat each cow produced the three weeks before and the three weeks following the test is estimated.

In view of the fact that the accuracy of records obtained by weighing and sampling each cow's milk at regular times during the year is often doubted, the Illinois station made a test of this method by comparing the amount of milk and butter fat sold from two farms to a creamery with the amount of milk and butter fat as determined by weighing and sampling each cow's milk every seventh week for fourteen consecutive milkings during the year. In one case there was found a difference of 2.2 per cent of butter fat and 0.0015 per cent in milk, making a difference of 4.07 pounds of butter fat and 8.09 pounds of milk to a cow; in the other case a difference of 0.038 per cent of fat and 1.98 per cent of milk, or 0.27 pound of butter fat and 120.3 pounds of milk to a cow. From these results it is seen that by carefully weighing and sampling each cow's milk every seventh week during her period of lactation records can be secured which are substantially correct.

The number of tests required during a period of lactation is illustrated further by an experiment made at the Illinois station, in which the milk of each of six cows was weighed and analyzed daily during

the whole period of lactation. The daily records of the six cows give data for comparing their total production of milk and butter fat during one period of lactation, as found from the daily weights and tests of their milk, with the total amount calculated from weights and tests made at intervals of 7, 10, 15, or 30 days. The average of all results obtained with each of the six cows shows that weighing and testing the milk for a cow every seventh day gave 98 per cent of the total milk and butter fat, which, according to her daily record, was the total product. Tests made once in two weeks gave 97.6 per cent of the total milk and 98.5 per cent of the total butter fat, and tests made once a month, or only ten times during the period of lactation, gave 96.4 per cent of the total milk and 97 per cent of the total production of butter fat.

The Vermont Experiment Station made a special study to determine when a cow should be tested in order to give a correct idea of the year's production, if only one or two tests are made during the lactation period. This station recommends, when only two tests of each cow's milk are to be made during the same lactation period, that samples be taken at the intervals given below:

Cows.	First sample—weeks after calving.	Second sample— months after calving.
For spring cows.....	6	6½-7½
For summer cows.....	8	6-7
For fall cows.....	8-10	5½-7

In case only one test is to be made, approximately correct results may be obtained by testing the milk in the sixth month from calving in case of spring cows, or in the third to the fifth month in case of cows which calve in the summer or fall. In all cases composite samples of the milk are to be taken for four days in the middle of the month, and the entire month's yield may be obtained with considerable accuracy, barring sickness and drying off, by multiplying the same by 7, 7½, or 7¾, according to the number of days in the month.

The Maryland station, after very exhaustive study of this question, decided that the seventh month in the lactation period would be the best to test a cow when only one test a year is to be made. But where a cow comes near the line of profit or loss a single test can not be depended upon for furnishing an accurate basis for judging her value. When two tests are to be made at different periods, this station found that the third and eighth months would be best; and when three tests are to be made, the third, sixth, and eighth months. To get the average for the year when more than one test

is made, the results of the tests are added together and the sum is divided by the number of tests. The amount of milk produced in a year multiplied by the average per cent of butter fat gives the yearly yield of fat. Whether the test is made one, two, or three times a year, it is recommended that composite samples be taken for a week. This minimizes the likelihood of any unnatural condition interfering with the correctness of the test. The precaution is added that the composite samples should not be taken when there is any visible sign of anything unnatural in the condition of the animal.

#### RAISING THE STANDARD.

It is interesting to note that the average production of milk and butter per cow in the United States has been increasing slowly yet constantly from one decade to another. The following data show the census returns from 1850 to 1900:

*Average production per cow in the United States.*

Year.	Milk.	Butter.	Year.	Milk.	Butter.
	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
1850.....	1,436	61	1880.....	2,004	85
1860.....	1,505	64	1890.....	2,709	115
1870.....	1,772	75	1900.....	3,646	155

While this increase is encouraging, even the record for the year 1900 is too low to afford the dairyman much profit at the average price for milk and butter. The record indicates further that many dairymen whose herds are below the average in production must be keeping cows at a loss. Every dairyman should study the individuality of his cows, set a standard, and maintain it by promptly disposing of the animals which fail to attain it, unless he has reason to believe that an animal will make a better record in the future. When the standard is reached it should be gradually but persistently raised. This can be done by keeping a sufficient record of the quantity and quality of the milk product, knowing approximately the cost of production, and systematically weeding out the herd.

#### RECORDS OF DAIRY COWS.

Some typical records of dairy cows are given in the following pages. They are selected from a large number of records collected by the Dairy Division and published in Bulletin No. 75 of the Bureau of Animal Industry. In obtaining these records dairy publications, reports of breeders' associations, and the various bulletins and reports of experiment stations were freely consulted. In addition to this,

600 circulars were sent direct to dairymen asking the following questions:

1. How many cows in your herd?
2. Give approximately their average age.
3. Please state the breed of your cows.
4. What breed of bull is used in your herd?
5. Do you raise your cows or purchase them?
6. At what time in the year do your cows freshen?
7. What rations do you feed in summer?
8. What rations do you feed in winter?
9. Please state (or estimate) the cost of keeping your cows per year.
10. What is the average annual production of milk of your cows?
11. What is the average annual production of butter of your cows?
12. Please state, if possible, the average percentage of butter fat in the milk of your herd.
13. Have any of your cows extraordinary records?

Over 200 replies were received. Of these about one-fourth stated that they did not keep records; others fed whole milk to their calves for several weeks, and for this reason were unable to give complete yearly records; still others kept records of only a few cows in their herds. A large number, however, were able to furnish excellent, well-kept records, but it is believed that a large proportion of those who did not respond had no records to offer.

#### RECORDS OF GRADE COWS.

##### RECORDS PROCURED DIRECT FROM DAIRYMEN.

These records are particularly valuable for the reason that the kind and cost of feed, age of cows, and other data are given in connection with them, showing some of the conditions under which they were made. The table on page 12 contains a summary of the information secured from dairymen who own grade and mixed herds. The character of the herds, the rations fed, and the milk and butter yields are shown.

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*Milk and butter-fat records of grade herds and herds of mixed breeding for one year, as reported by dairymen in different States.*

Owner.	State.	Number of cows in herd.	Average age.	Breed.	Breed of bull.	Cost of keeping cow.	Average annual production.		Average fat in milk.
							Milk.	Butter.	
							<i>Lbs.</i>	<i>Lbs.</i>	<i>P. ct.</i>
S. M. Wells & Son..	Conn.	42	8	Ayrshires (mainly), Guernseys, and Jerseys.	Ayrshire....	\$60.00	8,000	370	4.0
Geo. H. Bowker...	Mass.	20	5	Ayrshires (13) and grade Holsteins (7).	.....do.....	45.00	6,600	308	4.0
W. P. Edwards....	Mass.	6	5	Grade Ayrshires....	Holstein a...	55.00	6,450	375	5.0
Sam Jones & Son..	Wis...	32	7	Ayrshires (16) and scrubs (6).	Ayrshire....	28.00	6,310	280	3.8
J. F. Homewood...	N. C...	4	4	Ayrshires and Jerseys.	.....do.....	30.00	.....	150	.....
C. L. Peck.....	Pa....	24	7	Registered Ayrshires, registered Jerseys, and grades.	.....do.....	35.00	6,000	280	4.0
N. E. McKissick...	Me....	150	...	Ayrshires (50) and Ayrshire grades (100).	.....do.....	.....	5,000	264	4.52
A. S. Worden.....	Pa....	20	8	Devons, Holsteins, and grades.	Devon.....	30.00	6,223	305	4.2
A. B. Miles.....	N. Y...	30	2½	Holsteins and grade Holsteins.	Holstein....	35.00	6,000	210	3.05
H. V. Noyes.....	N. Y...	50	5	.....do.....	.....do.....	45.00	7,701	270	3.02
F. J. Boyson.....	N. Y...	40	7	.....do.....	.....do.....	27.35	7,000	270	3-3.6
W. W. Crittenden..	Mich...	5	3	Holsteins (4) and Jersey (1).	.....do.....	.....	6,175	258	3.58
Ellerslie Stock Farms.	N. Y...	70	7	Guernsey and Guernsey grades.	Guernsey...	50.00	6,200	350	4.9
H. W. Comfort.....	Pa....	50	6	.....do.....	.....do.....	40.00	6,000	315	4.5
G. M. Phifer.....	N. C...	55	6	.....do.....	.....do.....	23.00	6,278	.....	.....
L. D. Staples.....	Minn...	7	5	Grade Guernseys	.....do.....	35.00	5,300	265	4.3
N. I. Bowditch.....	Mass...	107	6	Grade Guernseys, grade Jerseys, and grade Holsteins.	.....do.....	55.00	7,665	364	4.2
Banning Bros.....	Mich...	30	8	Grade Guernseys; few grade Shorthorns.	Polled Short- horn.	38.00	5,805	303	4.5
A. G. Lewis.....	N. Y...	125	3	Guernseys and half- bloods.	Guernsey...	78.00	6,800	367	4.63
W. H. Russell.....	Iowa...	20	5	Guernseys and grades	.....do.....	28.00	6,000	362	5.2
W. R. Holcomb....	Minn...	55	6	Guernseys (37) and Holsteins (18).	Guernsey 1 Holstein 1.	43.00	5,800	315	4.66
H. McK. Twombly.	N. J...	180	5½	Guernseys (35), Guernsey and Jersey grades (145).	Guernsey...	61.00	6,707	360	4.6
C. W. Wilcox.....	Iowa...	35	7	Guernsey and Guernsey grades.	.....do.....	30.00	4,700	274	5.0
Briarcliff Farms...	N. Y...	496	5	Jerseys and 10 per cent high-grade Jerseys.	Jerseys reg- istered.	.....	5,197	349	5.6
C. T. Rossiter.....	N. H...	20	3	Jerseys and high- grade Jerseys.	.....do.....	50.00	5,925	380	5.5
R. S. & H. W. Davis.	Vt....	46	4½	Grade Jerseys.....	.....do.....	42.50	4,800	270	5.0
I. B. Witmer.....	Ohio..	8	7	Jersey and Jersey grades.	.....do.....	35.00	6,175	360	5.0
E. C. Birge.....	Conn.	18	7	Jersey and Holstein grades.	Guernsey or Jersey.	.....	5,000	245	4.2
Wm. Schulmerich..	Oreg...	27	5	Jerseys and grade Jerseys.	Jersey, reg- istered.	40.00	6,730	315	4.05
J. L. Hoyle.....	Iowa...	11	5	Grade Jerseys.....	.....do.....	35.00	4,738	305	5.5
L. J. Kendall.....	Mass...	50	6	Jersey, Guernsey, and grades.	Jersey.....	75.00	6,450	.....	.....
John Lynch.....	Cal...	50	6	Shorthorns and Shorthorn grades.	Shorthorn..	30.00	6,340	.....	.....

<sup>a</sup> The words Holstein and Holstein-Friesian as used in this article are synonymous.

The information embodied in the foregoing table shows that the average number of cows in a herd was 67; average age, 6 years; average cost of keeping 1 cow one year, \$41.88; average amount of milk produced annually, 6,243 pounds; average amount of butter produced annually, 306 pounds; percentage of fat in milk, 4.2.

HERDS OWNED BY CREAMERY PATRONS.

A representative of Hoard's Dairyman, detailed to make investigations concerning the patrons of creameries in various States, visited the farms, interviewed the patrons, and consulted the books of the creamery. Inquiries were made as to the number of cows kept during the year, the kind of cows and how bred, the cost of keeping the cows, the average ration, how the cows were stabled, the returns from the creamery per cow, the average number of pounds of butter per cow, the average price of butter for the year (the price to be net after taking out payment for making), the average price of milk per 100 pounds per year, and the patron's idea as to the value of skim milk.

The first investigation included 100 creamery patrons of Jefferson County, Wis., owning nearly 2,000 cows. There were but few full-blooded herds included in the number, but when the blood of one particular breed predominated in a herd it was classed as that breed. Where there was a mixture of dairy breeds and no single breed predominated they were classed "mixed dairy." The following table, arranged according to breeds and giving the average products and profits of each, is quoted from Hoard's Dairyman:

*Average results for herds of 100 creamery patrons of Jefferson County, Wis.*

Breed.	Number of herds.	Number of cows.	Yield of milk per cow.	Yield of butter per cow.	Returns from creamery for \$1 in feed.	Net profit per cow.
			<i>Pounds.</i>	<i>Pounds.</i>		
Jerseys.....	28	466	4,798	244.7	\$1.62	\$17.58
Holsteins.....	19	450	6,081	255.0	1.54	16.99
Guernseys.....	11	185	5,141	252.5	1.60	17.92
Mixed dairy.....	19	346	4,455	208.5	1.44	12.14
Natives.....	11	164	4,541	203.6	1.31	8.77
Dairy Shorthorns.....	6	113	5,436	240.8	1.48	14.77
General-purpose Shorthorns.....	4	54	4,219	194.4	1.22	7.08
Brown Swiss grade on Jersey foundation.	1	12	5,236	257.8	1.35	12.43

The reason for the differences in yield and profit was found to be mainly in the kind of cows kept and the kind of feed on which they were fed. Of course there are other minor factors that contribute to success in dairying, but these two were the most prominent here.

Some of the dairymen claimed that the most profitable method was to use only such feeds as were raised on their farms and not to pay out good money for concentrated feeds. Others were of the opinion that it paid a good profit to buy feeds so as to make a balanced ration

where the proper feeding stuffs were not raised on the farm. To test the matter the 100 patrons were divided into two classes. One class bought feed such as cotton-seed meal, oil meal, gluten feed, brewers' grains, malt sprouts, and wheat bran. The other class all fed corn and oats, which were the only grain feed their cows had. In all cases the cows were charged with the market value of all the feed they consumed; that is, the purchased feed at the price paid for it and the feed raised on the farm at the cash price at which it could have been sold. Forty-six patrons bought feed and received for butter from the creamery \$1.57 for each dollar's worth of feed the cows ate. The other 54 patrons bought no feed and received \$1.45 for each dollar's worth of feed consumed. Thus those who purchased feeds made 12 per cent more on the value of all the feed their cows ate than did the others. And it must be borne in mind that many of those who did buy feed and are counted in this class purchased only a little, in some cases but 1 or 2 tons of bran during the winter, not enough to have much effect in balancing a ration.

It is true that some who had cows of the best dairy type and gave them the best of care and attention realized good returns from their cows without buying feeds. The fact, however, remains that the patrons who secured the best records and received the greatest profits fed a fairly well balanced ration, and in order to do that they had to buy feeds rich in protein. It would be an ideal condition if the farmer could raise all the protein feed necessary to make his cows do their best. This is occasionally accomplished by raising such crops as clover, field peas, cowpeas, and soy beans. Until, however, crops are raised containing more protein than those ordinarily grown by the farmer it will be necessary to buy protein feeds if the best results are to be secured.

Some of the patrons made the mistake of having all their cows "come fresh" in the spring, thus producing the most milk when the price was low. After passing through the season of heat and flies the cows were nearly dry, and the best attempts had but little effect in bringing back the flow of milk during the winter. Many did not read dairy papers or make any effort to study out the principles of the dairy business, and as a rule these secured the lowest profit. It was noted that good dairymen, as well as poor ones, seemed to be in clusters. Here is shown the influence of a few progressive dairymen who for years studied their business and became intelligent in regard to it. Their neighbors followed their example. On the other hand, the example of those who did not read and study dairy methods was followed and they were all ignorant together, and as the result of their ignorance they received very little if any profit from their dairy cows.

In another creamery-patron investigation in three counties in New York it was pointed out that patrons received an average profit of 65 cents per cow. The cost of keeping a cow averaged a little over \$35 a head. Other things being equal, the silo men got the greatest profit from the expenditure for feed. The grade of cow kept, the skill shown in selecting feeds, and the care and intelligent attention to the needs of the cow were large factors in determining the results. In many cases better and cheaper rations were needed as well as better cows to turn the ration into milk. It was shown that the silo and the alfalfa crop would assist materially in reducing the cost of feeds and that dairy cows producing 5,000 pounds of milk a year were within the reach of every painstaking dairyman.

An investigation in two other counties in New York revealed the fact that a fair ration for a cow in that section of the country costs \$35 a year; that the average net returns for butter were not over 17 cents a pound, and the average price for milk was not over 9 cents per 100 pounds. At these prices the cow that did not make 200 pounds of butter a year, or nearly 4,000 pounds of milk, did not pay for her keeping. Dairy men who practiced the primitive methods of thirty, forty, and fifty years ago and failed to adapt their methods to the demands of a progressive age lost money. The reason they did not progress was because they did not avail themselves of the education in dairying and agriculture so cheaply offered to them by the dairy and agricultural papers, farmers' institutes, farmers' reading courses, experiment stations, agricultural colleges, etc.

A study was also made of fifty herds in Pennsylvania. The representative of Hoard's Dairyman who made these investigations stated that only about one-half of the dairy men visited read any kind of agricultural papers or seemed to be availing themselves of the means of education offered them. As a consequence of this lack of knowledge losses and leaks were found which robbed the dairyman of all the profits in his business. One great waste was in not having cows that responded to good care and feed. In some instances a very good ration was fed to a herd with little or no profit, while other herds that were fed almost the same ration returned a good profit. A lack of knowledge of the principles of breeding was also reported. Less than 10 per cent were keeping purebred sires descended from dams having good dairy records. Another waste was in the feeding of unbalanced rations. Sometimes the carbohydrates were far in excess of what the cow could utilize in milk production and the excess was wasted. For instance, some were feeding as high as 3 bushels of ensilage per cow daily. Too often the cornstalks were fed to the cattle dry and uncut, only a part being eaten. Little attempt was made to grow any protein soiling crop—such as alfalfa or oats and peas—to supplement the



pasture. About 75 per cent of the barns were reported not sufficiently warm. This also caused a waste of food nutrients. Not more than 10 per cent of the stables were provided with any system of ventilation other than windows, holes in the floor over the stable, and hay chutes. In addition to pure air, sunshine was also lacking in most cases. Too often the manure which should have enriched the soil and nourished the crops was wasted. One encouraging feature was that more than one-third of the dairymen had silos, and others were preparing to build them. They were finding that they could not profitably make winter milk without a cheap, succulent feed. A few dairymen were progressive and prosperous and making good profits, while some of their immediate neighbors were not. One patron received \$70 per cow from his whole dairy and \$1.79 for each dollar invested in feed. Not far from him was another patron who received only \$15 per cow and 50 cents for each dollar invested in feed.

In an investigation of one hundred dairy herds in Iowa it was noted that thirty-eight herds of the number gave less than a dollar's worth of butter for a dollar in feed, and one gave less than half a dollar's worth. Sixty-two herds paid a dollar or over, while four herds paid over \$2 for \$1 in feed. Most of the herds were fed liberally, and of some it might be said that they were heavily fed on grain. Only five herds were fed anything except the grain and forage raised on the farm, which consisted of corn in the majority of cases. A few used feeds richer in protein, and these secured better returns. Two or three fed a well-balanced ration and were well paid for it. One dairyman fed gluten feed, bran, and silage—a well-balanced, succulent ration—to high-grade dairy cows and realized \$2.30 in butter for each dollar's worth of feed. The cash received for butter was \$59.85, or a net profit of \$33.85 per cow. Another fed bran and silage with exceptionally good results. Still another fed bran and clover hay, which made a fairly good ration for a herd of full-blood dairy cows, and secured 325 pounds of butter per cow in return.

Investigations were made by Hoard's Dairyman in several other States, but it will not be necessary to include the results here. Enough data have been presented to show what hundreds of dairymen are actually doing.

#### INVESTIGATIONS OF DAIRY HERDS BY EXPERIMENT STATIONS.

For over a year the department of dairy husbandry of the Illinois Experiment Station conducted field work among the dairymen of the State. A number of them were persuaded to weigh and sample the milk a sufficient number of times during the year to make it possible to estimate the performance of each cow with some degree of accuracy. These records brought the farmers face to face with facts that existed

upon their own farms, and showed that some herds were kept at a good profit, some at a small profit, and others at an actual loss.

The following tables show the results of investigations with the herds referred to:

*Comparison of the average yearly performance of all the cows in each of the herds tested.*

Herd.	Yield of milk.	Fat in milk.	Yield of butter.	Net profit or loss.	Cost of 100 pounds of milk.	Cost of 1 pound of fat.
	<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>		<i>Cents.</i>	<i>Cents.</i>
Herd A.....	3,361	3.55	139	—\$4.54	92.5	25.8
Herd B.....	5,360	3.52	220	12.12	57.0	16.1
Herd C.....	4,942	3.90	224	16.22	55.5	14.2
Herd D.....	5,911	4.45	306	26.64	54.9	12.3
Herd E.....	6,474	4.19	317	35.80	43.8	10.4
Herd F.....	5,846	3.32	227	18.58	42.9	12.9
Herd G.....	4,865	3.95	224			
Herd H.....	3,852	4.02	180			

In estimating in the above table the profit or loss on a cow it was counted that the calf paid for her keep while dry and the skim milk paid for the labor.

*Comparison of the results from the six most profitable cows in herd D with the results from five other herds.*

Herd.	Number of cows in herd.	Total yield of milk.	Total yield of butter.	Total profit.	Total loss.
		<i>Pounds.</i>	<i>Pounds.</i>		
Herd D.....	6	50,669	2,644	\$296.97	
Herd A.....	28	94,126	3,890		\$127.12
Herd B.....	20	107,217	4,409	242.41	
Herd C.....	17	84,014	3,823	275.90	
Herd E.....	7	45,322	2,220	250.63	
Herd F.....	14	81,845	3,178	260.15	

This table shows clearly that a few good cows will yield a greater profit than large herds of unselected animals. It was found in herd D that 15 of the best cows gave a profit of \$651.94, while the other 32 cows gave a profit of only \$600.24, or the 15 cows gave the owner \$51.70 more profit than the 32 other cows.

The following table shows the average yield of milk and butter fat per cow, with gross cash returns for the same, in fifty-eight Arizona herds as reported by the Arizona State Experiment Station:

*Average results with fifty-eight Arizona herds.*

No. of herd.	Number of cows.	Average yield of milk.	Average yield of butter fat.	Average cash return.	No. of herd.	Number of cows.	Average yield of milk.	Average yield of butter fat.	Average cash return.
		<i>Pounds.</i>	<i>Pounds.</i>				<i>Pounds.</i>	<i>Pounds.</i>	
1.....	21	7,499	274.00	\$54.80	30.....	25	4,865	191.15	\$38.23
2.....	8	7,587	269.20	53.84	31.....	9	5,240	189.30	37.86
3.....	43	5,936	247.00	49.40	32.....	19	4,795	188.00	37.60
4.....	48	6,676	236.60	49.32	33.....	11	5,167	187.90	37.58
5.....	23	5,659	243.00	48.60	34.....	54	5,150	185.20	37.04
6.....	4	6,019	238.15	47.63	35.....	19	4,302	183.60	36.72
7.....	9	3,447	233.85	46.77	36.....	9	5,312	183.60	36.72
8.....	21	4,438	234.00	46.00	37.....	7	5,229	179.25	35.85
9.....	12	6,176	222.00	44.40	38.....	5	4,833	178.55	35.71
10.....	31	6,442	219.10	43.82	39.....	6	4,667	177.35	35.47
11.....	24	6,048	214.40	43.00	40.....	8	4,632	176.30	35.28
12.....	16	5,672	214.85	42.97	41.....	9	5,095	169.05	33.81
13.....	23	4,972	214.00	42.80	42.....	9	4,655	161.10	32.22
14.....	29	5,863	214.00	42.80	43.....	11	4,292	158.20	31.64
15.....	9	5,255	213.85	42.77	44.....	7	4,154	154.70	30.94
16.....	25	5,778	210.00	42.00	45.....	12	4,282	150.40	30.08
17.....	12	5,559	208.15	41.63	46.....	7	4,187	145.20	29.04
18.....	55	5,681	205.15	41.03	47.....	6	4,411	144.25	28.85
19.....	15	5,944	204.60	40.92	48.....	12	4,248	127.55	25.51
20.....	11	5,607	202.50	40.50	49.....	3	2,973	125.80	25.16
21.....	15	Cream.	201.00	40.20	50.....	10	4,085	125.75	25.15
22.....	6	5,942	200.45	40.09	51.....	11	3,520	124.25	24.85
23.....	43	5,505	200.00	40.00	52.....	6	3,735	113.00	22.60
24.....	4	4,774	200.00	40.00	53.....	4	3,075	109.10	21.82
25.....	10	4,819	199.50	39.90	54.....	5	3,059	102.50	20.50
26.....	17	4,658	199.50	39.90	55.....	20	3,297	101.65	20.33
27.....	6	5,886	198.10	39.62	56.....	5	2,585	99.80	19.96
28.....	44	5,232	197.50	39.50	57.....	5	2,642	87.15	17.43
29.....	9	5,462	192.25	38.45	58.....	11	2,019	66.40	13.28

Of the fifty-eight herds reported, the last sixteen (Nos. 43-58) failed to pay what was estimated to be the cost of keeping (\$32). The difference between the returns from the average cow of the poorest herd and the average cow of the best herd is the difference between a loss of \$18.72 and a profit of \$22.80.

RECORDS OF DAIRY HERDS AT EXPERIMENT STATIONS.

The records presented here are of special interest and value for the reason that they have been kept with the greatest care and accuracy, and show the possibilities of production with grade herds under most favorable conditions of feeding and management, while at the same time many of the cows making up the herds were purchased of dealers in the vicinity of the station at moderate prices and were, therefore, no better than could be secured by any dairyman. The experiment stations have demonstrated very clearly that the dairyman must get above average conditions to attain success, and that he must use business methods and avail himself of the latest and best knowledge of the subject.

The following table comprises the data for the dairy herds at eighteen agricultural colleges and experiment stations:

*Average yearly records of grade herds at agricultural colleges and experiment stations.*

State.	Number of cows.	Average age.	Breed.	Breed of bull.	Cost of keeping cow.	Average annual production.		Average fat.
						Milk.	Butter.	
		<i>Yrs.</i>				<i>Lbs.</i>	<i>Lbs.</i>	<i>P. ct.</i>
Pennsylvania..	27	.....	Grade. Guernseys (24) and Guernseys (3).	Guernsey.....	\$45.00	5,436	320.0	5.1
Arizona.....	6	4	Natives.....	Jersey.....	32.00	5,340	325.0	5.22
Michigan.....	20	5	Holsteins, Shorthorns, Jerseys, Brown Swiss.	Holstein, Short-horn, Jersey, Brown Swiss.	41.00	7,444	344.0	3.96
New Jersey....	28	.....	Grade Jerseys, grade Guernseys, grade Ayrshires, grade Holsteins.	1 Guernsey, 1 Ayrshire.	45.00	6,528	335.0	4.41
New York (Cornell).	19	4½	Largely grade Jerseys and grade Holsteins.	1 Holstein, 1 Jersey.	45.25	7,327	322.0	3.76
Tennessee.....	30	.....	Three-fourths herd Jerseys, rest grades.	Jersey.....	{35.00- 40.00}	5,40	320.0	5.1
Utah.....	18	.....	Natives, grade Devons, grade Jerseys.	do.....	21.33	5,713	276.5	4.15
Wisconsin.....	21	7	Pure breeds and grades of Jerseys, Guernseys, Holsteins, Shorthorns, Red Polled.	Jersey, Guernsey, Holstein, Shorthorn, Red Polled.	38.00	7,309	369.0	4.19
North Carolina.	7	8	Grade and registered Holsteins and Jerseys.	Jersey.....	40.00	5,673	324.0	4.9
Indiana.....	14	.....	Jerseys and Holsteins.	Jersey and Holstein.	{32.00- 43.00}	6,211	304.0	4.2
Oregon.....	10	4½	Registered and grade Jerseys, Ayrshires, and Holsteins.	Registered Jersey.	30.00	4,962	258.0	4.47
Nebraska.....	.....	.....	Jerseys, Holsteins and grades, Shorthorns.	Jersey, Short-horn, Holstein.	25.00	5,902	320.0	4.65
Alabama.....	7	6	5 Jerseys, 1 Holstein (1901).	do.....	24.00	4,136	231.0	4.79
Kansas.....	49	5	Jerseys, Holsteins, Ayrshires, Red Polled, Shorthorns, Guernseys, and scrubs.	Jersey, Holstein, Ayrshire, Red Polled, Shorthorn.	32.00	6,288	293.0	3.99
Vermont.....	41	8	Ayrshires and grade Jerseys.	Jersey.....	51.00	5,558	329.0	5.07
Connecticut....	20	.....	Registered and grade Jerseys, Guernseys, Ayrshires, and Shorthorns.	do.....	53.46	5,498	326.0	5.08
Missouri.....	30	9	Jerseys, 6 Holsteins.	Jersey and Holstein.	28.00	6,000	350.0	5.1
Minnesota.....	23	.....	Pure bred and grade Jerseys, Guernseys, Holsteins, and Shorthorns.	do.....	37.82	6,408	351.0	4.7

The information embodied in the foregoing table shows that the average number of cows to a herd was 22; average age, 6 years; average cost of keeping 1 cow one year, \$36.94; average amount of milk produced annually, 5,951 pounds; average amount of butter produced annually, 316 pounds; percentage of fat in milk, 4.5.

The first of the accompanying charts (fig. 5) shows graphically the average production of milk, butter fat, and solids not fat given by each cow in the herd at the Utah Agricultural College, and brings out prominently the great variation in production for the different cows in the herd.

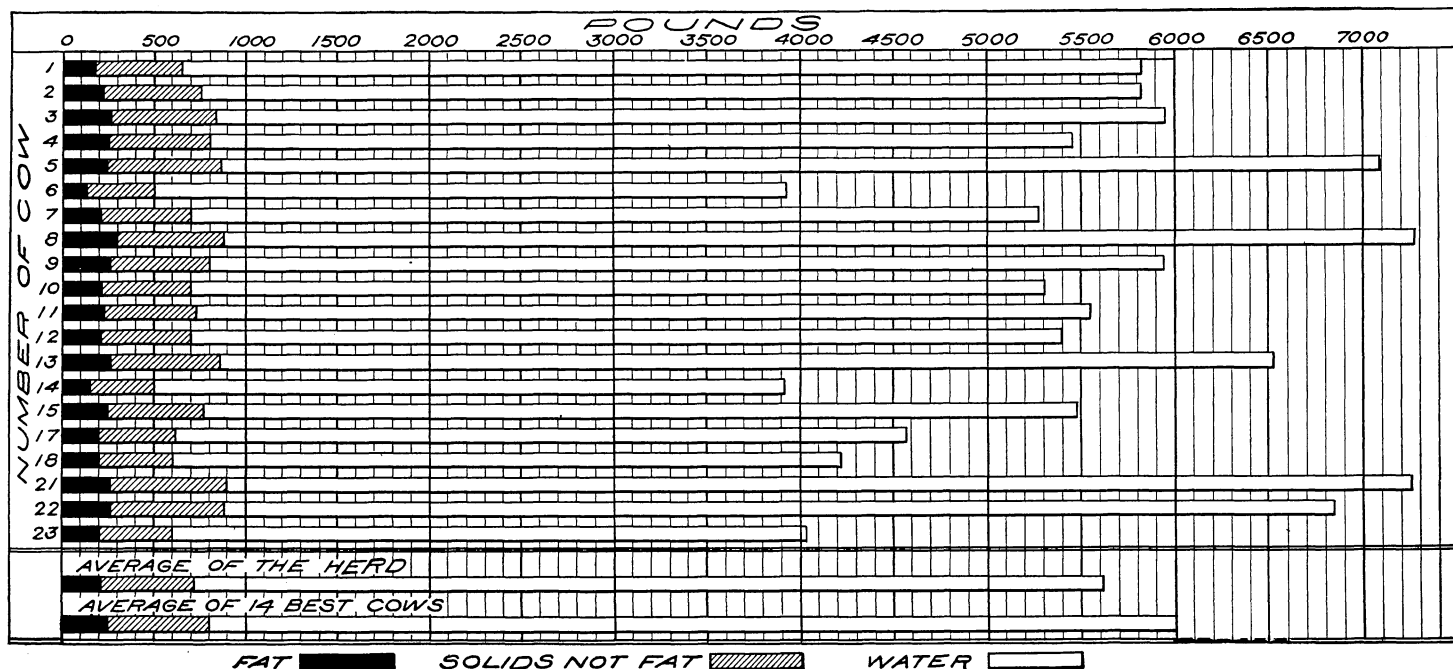


FIG. 5.—Chart showing milk, butter fat, and solids not fat yielded by cows of Utah Experiment Station herd.

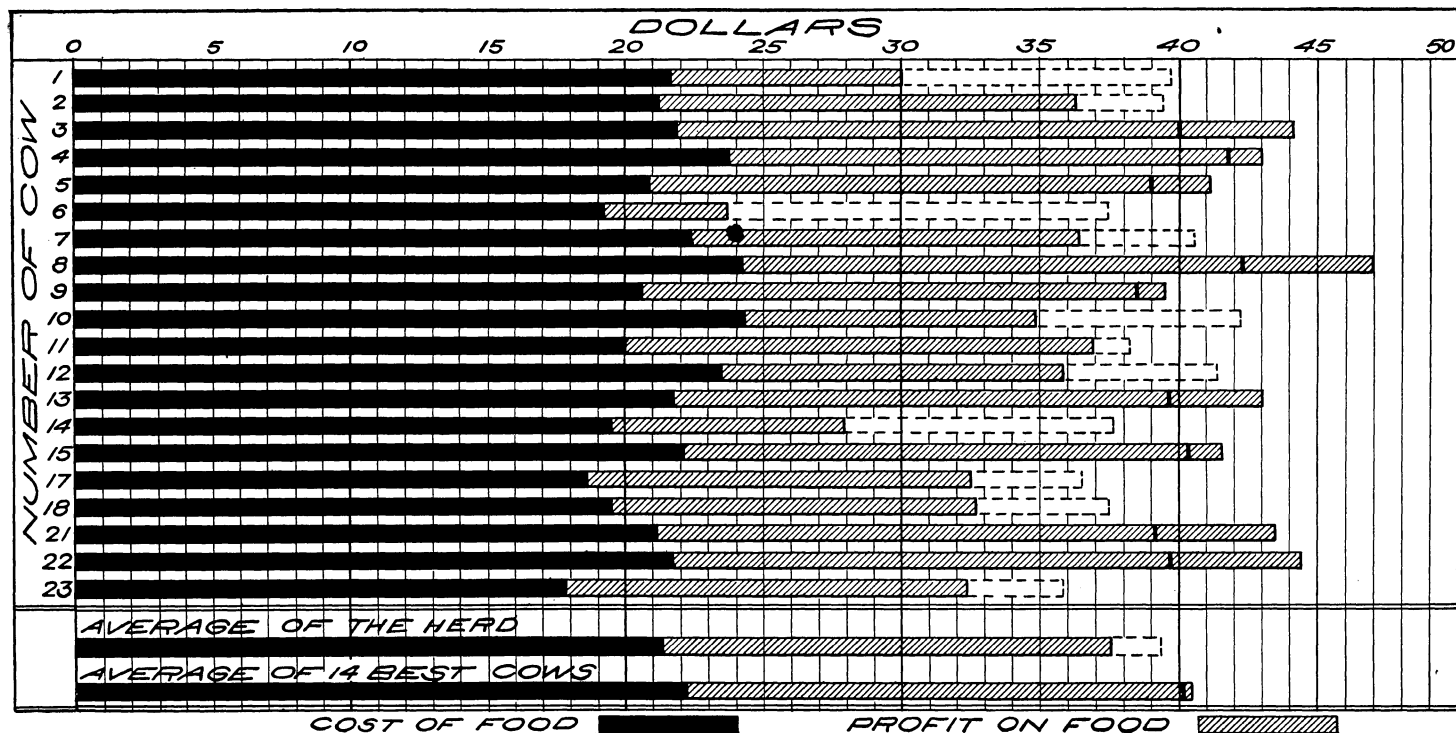


FIG. 6.—Chart showing yearly returns per cow of Utah Experiment Station herd on the basis of 16 cents a pound of butter fat. The dotted extensions show how much more the cow should have returned to pay \$18 a year for labor. Ten out of the 20 cows gave returns sufficient to pay cost of food, \$18 for labor, and a profit in addition, the amount of which is indicated by the extensions beyond the short heavy perpendicular lines.

The second chart (fig. 6) shows the average yearly returns from the cows figured on the basis of butter fat at 16 cents per pound, and brings out prominently the great variation in profit from the different cows.

#### RECORDS OF SINGLE GRADE COWS.

While records of dairy cows for a full year are valuable, records for series of years are still better. Dairy cows have their off years, and this must be considered when cows having poor records are being dropped from the herd. If this fact is not borne in mind there is danger of selling the best cows. Attention is called to a cow, Sweet Briar, of the Minnesota Experiment Station, that produced for ten years an average of 358.07 pounds of butter a year, while in 1898 she produced only 206.06 pounds of butter, in 1899 she made 306.53 pounds, and in 1901, 370.53 pounds. If the merits of Sweet Briar had been wholly based on the work she did in 1898 she would possibly have been dropped from the herd. The great value of scales and the Babcock test lies in their continued use in the dairy herd. It sometimes happens that promising heifers do very poorly the first year. In such cases the heifer's individuality, together with her breeding, should be considered before disposing of her. A good cow, however, seldom has two off years in succession.

A few examples of records of single grade cows for series of years in experiment station herds are given herewith and are worthy of careful study. They show the possibilities in production where cows are well fed and managed, and that grade cows may return a liberal profit for seven, eight, and even nine years.

#### *Records of grade cows for series of years at the University of Wisconsin Agricultural Experiment Station.*

Name of cow.	Breed.	Year.	Weight of cow.	Days in milk.	Yield of milk.	Fat in milk.	Yield of butter fat.	Value of products.	Cost of feed.	Profit.
			<i>Lbs.</i>		<i>Lbs.</i>	<i>Per ct.</i>	<i>Lbs.</i>			
Maud.....	Grade Shorthorn.	1898	1,176	338	6,997.5	4.29	300	\$78.39	\$40.50	\$37.89
		1899	1,118	336	7,960.2	4.17	332	86.94	40.72	46.22
		1900	1,132	304	8,695.4	3.99	347	91.02	43.15	47.87
		1901	1,164	334	10,782.1	3.76	405	107.33	42.80	64.53
		1902	1,175	291	9,694.0	3.80	368	97.43	33.98	46.45
		Average.....	1,153	320	8,825.4	3.97	350	92.22	40.23	52.00
Bessie.....	Grade Guernsey..	1898	868	294	6,651.1	4.81	320	82.58	37.48	45.10
		1899	847	306	6,565.1	4.74	311	80.47	44.11	36.36
		1900	894	329	7,977.7	4.44	354	92.17	38.69	53.48
		1901	987	327	7,021.3	4.68	329	85.21	35.22	49.99
		1902	922	371	7,333.0	4.28	314	85.55	34.04	51.51
		Average.....	903	325	7,109.6	4.53	322	85.19	37.90	47.29

*Records of grade cow for series of years at the Cornell University Agricultural Experiment Station, New York.*

Name of cow.	Breed.	Age.	Date of calving.	Number of lactation.	Weeks in lactation.	Total yield of milk.	Fat in milk.	Total butter fat.
Ruby.....	½ Holstein.....	<i>Yrs.</i> 3 4 5 6 7 8	Sept., 1891 Nov., 1892 Feb., 1894 Jan., 1895 Dec., 1895 Dec., 1896	2 3 4 5 6 7	53 57 40 38 48 64	<i>Lbs.</i> 9,174.50 9,968.25 11,086.00 10,781.50 13,574.00 16,089.50	<i>Per ct.</i> 3.49 3.44 3.49 3.42 3.17 3.24	<i>Lbs.</i> 320.23 342.84 386.50 369.01 430.15 521.32
Average.....						11,778.95	3.35	395.01

*Records of grade cows for series of years at the Utah Agricultural Experiment Station.*

No. of cow.	Breed.	Year.	Age.	In milk.	Milk yield.	Butter fat in milk.	Yield of butter fat.	Total cost of food.
6	Grade Devon.....	1894-95 1895-96 1896-97 1897-98	7 8 9 10	<i>Days.</i> 329 316 347 169	<i>Pounds.</i> 4,196 3,699 3,899 2,886	<i>Per cent.</i> 3.72 3.87 3.79 3.49	<i>Pounds.</i> 156.0 143.0 147.7 100.8	<i>\$</i> 20.07 19.53 18.37 9.90
	Average.....			290	3,670	3.73	136.9	16.97
9	Grade Devon.....	1894-95 1895-96 1896-97 1897-98 1898-99	5 6 7 8 9	365 335 305 345 261	6,367 6,176 5,308 5,974 4,135	4.27 4.18 4.72 4.48 4.49	271.9 258.3 250.3 267.5 185.8	19.71 22.79 23.10 20.89 16.71
	Average.....			322	5,592	4.41	246.7	20.64

*Records of grade cow for series of years at the New Jersey Agricultural Experiment Station.*

Name of cow.	Breed.	Year.	Yield of milk.	Fat in milk.	Yield of butter fat.
Model.....	Grade Jersey.....	1897 1898 1899 1900 1901 1902 1903	<i>Pounds.</i> 8,302.9 7,424.4 6,695.3 7,694.9 8,351.7 7,982.5 6,685.1	<i>Per cent.</i> 4.0 4.1 4.1 4.3 4.2 4.5 4.1	<i>Pounds.</i> 332.0 304.4 274.5 328.7 348.7 361.3 275.7
Average.....			7,591.0	4.18	317.9

*Records of grade cow for series of years at the Vermont Agricultural Experiment Station.*

Name of cow.	Breed.	Year.	Age.	Days in milk.	Yield of milk.	Fat in milk.	Total solids in milk.	Yield of butter fat.	Total cost of food.	Proceeds from butter.	Value of fertilizing ingredients.
Golden Rod..	Grade Jersey.	1894-95 1895-96 1896-97 1897-98 1898-99 1899-1900 1900-1901 1901-2 1902-3	<i>Yrs.</i> 3 4 5 6 7 8 9 10 11	<i>Lbs.</i> 365 308 326 292 298 286 306 323 329	<i>Lbs.</i> 5,327 5,399 5,886 5,372 5,379 4,556 4,901 4,482 4,413	<i>P. ct.</i> 6.67 6.21 6.27 5.96 6.19 6.75 6.28 6.45 6.71	<i>Per ct.</i> 16.40 15.80 15.85 15.40 15.59 16.60 16.09 16.31 16.90	<i>Lbs.</i> 355.3 335.1 368.8 320.1 333.0 307.5 307.8 289.3 296.3	<i>\$</i> 54.30 46.62 49.09 48.74 47.99 54.93 54.46 52.32 61.21	<i>\$</i> 97.41 89.92 104.34 96.20 101.02 97.74 98.78 93.64 103.70	<i>\$</i> 23.70 22.65 25.00 23.80 29.43 33.31 30.40 37.11
Average (9 years).....				315	5,090	6.36		323.7	52.18	98.08	



The milk and butter-fat records of single grade cows for short periods are also of interest in showing the possibilities in dairy production, but must be coupled with more extended tests if true dairy capacity is to be determined. A few illustrations are presented below.

*Milk and butter-fat records of single grade cows for short periods.*

Owner.	State.	Name of cow.	Breed.	Time.	Total yield milk.	Fat in milk.	Yield of butter fat.
J. L. Kendall.....	Massachusetts.	Guernsey Maid.	Grade Guernsey.	Days. 1	Lbs. 37.86	P. ct. 5.65	Lbs. 2.14
New Jersey Experiment Station.	New Jersey...	No. 4.....	.....do.....	7	316.0	4.5	14.28
J. H. Bennett.....	New York.....	.....	Grade Holstein...	1	73.0	.....	.....
New Jersey Experiment Station.	New Jersey...	Queen.....	.....do.....	7	381.8	3.9	14.88
Do.....	do.....	.....do.....	.....do.....	30	1,582.5	3.43	54.28
N. I. Bowditch.....	Massachusetts.	.....	Grade Jersey.....	1	57.0	.....	.....
Hatch Experiment Station.	do.....	Pearl.....	.....do.....	7	247.2	7.4	18.3
Experiment Station.....	Pennsylvania.	.....	.....do.....	28	1,097.9	5.8	63.7
New Jersey Experiment Station.	New Jersey...	No. 5.....	Grade Shorthorn.	7	356.6	4.5	15.88

#### RECORDS OF PUREBRED COWS.

The keeping of accurate records is perhaps of more importance to the owner and breeder of purebred stock than to dairymen who have nothing but grade and native cows in their herds. With the breeder of purebred stock the products of the dairy are often a secondary matter, his principal business being to breed and sell the animals. If he can present creditable records of the cows and heifers which he has for sale, as well as those of their ancestors for some years before, naturally these will assist in advertising and selling his stock. It was the aim of the writer to collect records of purebred cows of various breeds under a variety of conditions of soil and climate, and it is believed that the results obtained are of some value, not only to the dairyman, but to the breeder as well.

#### RECORDS OF PUREBRED HERDS FOR ONE YEAR.

In the following table are summarized data relating to a large number of purebred herds as secured direct from dairymen. This includes some information in addition to milk and butter records, and should give some light to those seeking dairy knowledge.

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*Milk and butter records of purebred herds for one year, as reported by dairymen in various States.*

Owner.	State.	Number of cows.	Average age.	Breed.	Cost of keeping cow.	Average annual production.		Average fat in milk.
						Milk.	Butter.	
			Yrs.			Lbs.	Lbs.	P. ct.
John P. Buckley.....	Me.....	25	6	Ayrshire.....	\$60.00	6,500	280	3.8
W. P. Schauck.....	N. Y.....	35	4	do.....	47.00	.....	.....	4.2
Geo. C. Clark.....	N. H.....	15	4½	do.....	35.00	6,480	300	.....
Geo. H. Yeaton.....	N. H.....	18	7	do.....	70.00	7,100	301	3.6
L. S. Drew.....	Vt.....	22	8	do.....	40.00	6,000	300	.....
E. B. Sherman.....	R. I.....	75	5	do.....	.....	.....	.....	3.0
C. A. Abell.....	Vt.....	13	4	do.....	35.00	.....	.....	3.9
E. A. Holt.....	N. H.....	20	7	do.....	.....	.....	.....	.....
Melrose Farm.....	Va.....	32	7	do.....	50.00	5,545	243	3.76
L. D. Stowell.....	N. Y.....	40	5	do.....	35.00	7,000	300	.....
E. J. Fletcher.....	N. H.....	25	4	do.....	40.00	7,000	.....	4.9
J. F. Butterfield.....	Pa.....	15	4½	do.....	30.60	.....	250	4.25
E. F. Pember.....	Me.....	30	6	do.....	40.00	6,000	300	4.25
W. V. Probasco.....	N. J.....	15	7	do.....	43.00	7,377	347	4.2
C. M. Winslow.....	Vt.....	30	5	do.....	50.00	7,183	320	3.82
C. H. Hayes & Son.....	N. H.....	.....	6½	do.....	30.00	6,000	259	3.7
Hull Bros.....	Ohio.....	10	5	Brown Swiss.....	.....	6,681	.....	.....
M. W. Oliver.....	Pa.....	10	8	Devon.....	26.00	5,100	250	4.3
L. V. McWhorter & Sons.....	Wash.....	9	5	North Devon.....	16.00	11,849	.....	.....
J. W. Swab.....	Ohio.....	37	5	Dutch belted.....	32.00	5,840	.....	3.6
Howard P. Tuttle.....	Conn.....	18	.....	Guernsey.....	59.00	4,598	.....	5.54
L. V. Axtel.....	Ohio.....	35	5	do.....	40.00	7,000	375	5.0—
J. G. Hickcox.....	Wis.....	15	5	do.....	.....	7,000	350	.....
J. C. Chambers.....	Mich.....	25	6	do.....	30.00	8,000-10,000	.....	5.0
Chas. Solveson.....	Wis.....	25	6	do.....	35.00	6,400	370	5.0
Ezra Michener.....	Pa.....	20	6	do.....	50.00	7,000	390	5.0
E. P. Turner.....	Me.....	18	6	do.....	.....	4,610	275	5.0
B. Clark & Son.....	Wis.....	19	5	do.....	40.00-45.00	6,000	325	5.0
A. E. Pelton.....	Iowa.....	14	6	do.....	24.75	.....	300	4.0
F. B. Fargo.....	Wis.....	45	4½	Holstein.....	45.00-50.00	6,000-10,000	225-375	.....
Isaac Dalrymple.....	N. Y.....	30	5	do.....	.....	8,000	.....	.....
McKay Bros.....	Iowa.....	30	.....	do.....	.....	8,500	335	3.4
State Hospital.....	Vt.....	45	7	do.....	35.00	7,600	.....	.....
J. H. D. Whitcomb.....	Mass.....	60	6	do.....	50.00-75.00	10,000-12,000	.....	3.9
W. H. Grenell.....	N. Y.....	40	4	do.....	35.00	.....	275	3.8
Nick Grimm.....	Wis.....	22	6	do.....	30.00	8,000	.....	3.5-3.8
W. O. Jackson & Sons.....	Ind.....	31	3	do.....	30.00	.....	430	3.5
J. H. Coolidge & Sons.....	Ill.....	25	5	do.....	30.00-35.00	8,500-9,000	.....	3.6
W. C. Hind.....	N. Y.....	70	5	do.....	.....	10,000	375	.....
W. M. Benninger.....	Pa.....	16	5	do.....	50.00	10,000	450	4.0
E. E. Randall.....	Wis.....	35	4	do.....	35.00	14,000	.....	3.7
Knapp & Pierce.....	Ohio.....	30	4	do.....	30.00	10,000	.....	3.8
C. D. Holt & Son.....	Wis.....	35	5	do.....	.....	4,500	200	.....
I. L. Curtis.....	Wis.....	15	5	do.....	30.00	.....	350	3.6
W. B. Smith & Son.....	Ohio.....	90	5	do.....	55.00	9,850	.....	.....
A. B. Chase.....	N. Y.....	28	6	do.....	51.00	7,500	328	.....
A. A. Cortelyou.....	N. J.....	110	.....	do.....	60.00	7,000-12,000	.....	3.7
The Stevens Bros.-Hastings Co.....	N. Y.....	150	.....	do.....	45.00-50.00	8,000-12,000	.....	.....
Gardner & Misner.....	N. Y.....	25	5	do.....	50.00	9,304	370	3.4
W. R. Gates.....	Wis.....	14	5	do.....	35.00	8,000	300	3.5
J. B. Irwin.....	Minn.....	20	4	do.....	50.00	10,000	400	3.45
J. H. Mead.....	Vt.....	14	6	do.....	72.00	14,000	.....	.....
S. Mather & Sons.....	N. Y.....	32	5	do.....	40.00	8,326	355	3.66
F. W. Allis.....	Wis.....	40	4½	do.....	.....	7,507	263	.....
W. H. Jones.....	Wis.....	30	5	do.....	27.00	10,000	430	3.7
Gillett & Son.....	Wis.....	20	4½	do.....	40.00-50.00	11,515	.....	3.6
C. F. Stone.....	Kans.....	15	6	do.....	22.00	10,500	.....	.....
E. J. Burrell.....	N. Y.....	150	7	do.....	38.00	6,500	.....	.....
Thos. Fassitt & Sons.....	Md.....	23	7	do.....	30.00-35.00	6,000-10,000	.....	3.5-3.8
F. G. Johnston.....	Ohio.....	16	5	do.....	50.00	8,000	345	3.7
Don J. Wood.....	N. Y.....	33	.....	do.....	.....	7,664	.....	.....
A. J. Daugherty.....	Ill.....	100	5	do.....	50.00	12,000	500	3.4-4.0
Eastern Mich. Asylum.....	Mich.....	59	.....	do.....	50.00	9,768	.....	.....
Pierce Land and Stock Co.....	Cal.....	150	5	do.....	30.00	10,000	430	3.7
A. W. Brown.....	N. Y.....	36	4	do.....	.....	8,128	332	3.5
Wm. B. Goodrich.....	Iowa.....	15	5½	Jersey.....	35.00	6,570	398	5.2
G. H. Sweet.....	N. Y.....	22	7	do.....	68.00	6,550	405	5.3
R. W. Ellis.....	Me.....	24	5	do.....	30.00	5,000	300	5.25
David Roberts.....	N. J.....	70	6	do.....	50.00	5,650	.....	5.5
W. R. Spann.....	Tex.....	60	6	do.....	32.50	.....	389	5.0
Biltmore Farms.....	N. C.....	130	8	do.....	.....	5,365	383	.....

° Average of 5 cows for four months (not counted in general average).

*Milk and butter records of purebred herds for one year, as reported by dairymen in various States—Continued.*

Owner.	State.	Number of cows.	Average age.	Breed.	Cost of keeping cow.	Average annual production.		Average fat in milk.
						Milk.	Butter.	
			Yrs.			Lbs.	Lbs.	P. ct.
The Billings Farm	Vt.	26		Jersey	\$48.00	6,325	402	5.45
E. R. Hicks	Wis.	40	6	do.	50.00	7,280	467	5.5
Reform School	Pa.	21	5	do.		5,037	289	4.9
G. V. Saffarrans	Mo.	20	6	do.	25.00		400	5.2
Widemere Herd	Me.	25	6	do.	50.00	4,800-6,000	300-350	5.4
W. L. Bradbury	Va.	10	6½	do.	35.00	5,548	353	5.45
G. V. Woollen	Ind.	20	5	do.	40.00	5,000		5.0
Joseph Mailliard	Cal.	250	7	do.	45.00	4,800	300	
T. F. Marston	Mich.	70	6	do.	45.00	6,000	385	5.5
J. K. Honeywell	Neb.	30	6	do.	34.00	5,994	319	
F. L. Davis	Vt.	20	4	do.	46.50	6,000	340-365	
H. C. Young	Neb.	34	5	do.	35.00	5,000	290	5.0
Austin Leonard & Son	Pa.	19	6	do.	40.00	5,160	300	5.0
S. H. Joiner	Wis.	12	8	do.	35.00	6,000	364	5.2
D. H. Olds	Ohio	100	5	do.	35.00	5,000		5.0
W. J. Hussey	Ohio	35	5	Jersey	35.00	4,000	240	5.3
M. A. McDonald	Ind.	50	3	do.	35.00		350	5.0
D. A. Jordan	Ind.	25	6	do.	32.00	5,000	275	5.0
John F. White	N. Y.	250	6	do.	50.00	6,500	395	5.2
W. Gettys	Tenn.	50	6	do.	45.00		300	5.0
J. A. Middleton	Ky.	27	4	do.	60.00	4,523		5.0+
E. B. Cooper	Mo.	30	6	do.		3,000		5.0
A. F. Peirce	N. H.	25	5	do.	50.00	6,000	380	5.44
M. M. Offutt	Tex.	10	4	do.	40.00	6,000-7,000	350-400	5.0
O. B. Yates	N. Y.	8	5	do.		5,620	341	5.2
M. H. Olin	N. Y.	59	6	do.	37.00		383	5.4
F. G. Craft	Ind.	20	5	do.	30.00	4,750	295	5.4
C. LeB. Homer	Pa.	29	4	do.		7,500		5.0
A. O. Auten	Ill.	60	7	do.	48.50		300	5.04
N. H. Robinson	Wis.	24	7	do.	34.50	7,176	470	5.77
C. O. McAhron	Mo.	7	7	do.	30.00	4,790		5.5
A. M. Stevens	Wash.	13	5	do.		6,765	469	
L. P. Bailey	Ohio	40		do.	40.50	5,200		5.35
H. R. Ihrie	Miss.	35	3	do.	36.00	4,000	350	
A. H. Cooley	N. Y.	40	7	do.		8,000		5.2
W. & I. Mekeel	N. Y.	26	5	do.	40.00	5,153	332	5.5
F. H. Scribner	Wis.	21	7	do.	35.00	7,665		5.6
F. E. Dawley	N. Y.	40	6	do.	36.00	7,060	408	5.1
Estate of A. Chisholm	Cal.	18	6	do.	30.00	5,500	400	
J. W. Martin	Wis.	48	6	Red Polled	35.00	6,000	300	4.4
P. G. Henderson	Iowa	22	10	do.	30.00	5,713	270	4.1
Frank Hartline	Ohio	9	5	do.		7,000-10,000	355	
Calvin Lovett	Mich.	28	7	Shorthorn	20.00	7,000	300	
J. K. Innes	N. Y.	60	7	do.	42.00	6,800	299	

The annual cost of feeding a cow ranged, with 95 dairymen reporting, from \$16 to \$75, the average being \$40.36. The average of the milk yield reported by 99 dairymen was 7,093.1 pounds, and the average butter yield reported by 78 dairymen was 341.2 pounds. It should be remembered that most of these dairymen practiced up-to-date methods, were careful feeders as well as breeders, and kept careful records of their work. These records present a great contrast to those reported under creamery-patron investigations.

RECORDS OF PUREBRED HERDS FOR SERIES OF YEARS.

These records, one of which has been continuous for twenty-five years, show the possibilities of maintaining a herd at a high standard of production, this being done largely by raising the best heifer calves from the best cows. Owing to lack of space, only one record of each breed can be presented here for illustration.

*Milk and butter-fat records of purebred herds for series of years.*

Owner.	Breed	Num- ber of cows in herd.	Year.	Average milk yield.	Average fat in milk.	Average yield of butter fat.
				<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>
C. M. Winslow, Vermont.....	Ayrshire.....	10	1880	6, 035		
		11	1881	6, 176		
		9	1882	6, 672		
		15	1883	6, 168		
		16	1884	6, 814		
		11	1885	7, 025		
		16	1886	6, 238		
		16	1887	5, 782		
		16	1888	6, 356		
		15	1889	5, 836		
		17	1890	5, 480		
		14	1891	5, 971		
		12	1892	6, 249	4.23	264.3
		10	1893	6, 233	4.04	251.7
		19	1894	6, 455	4.01	258.8
		17	1895	6, 765		
		16	1896	7, 289	4.0	291.5
		15	1897	7, 228		
		19	1898	6, 956		
		17	1899	6, 180		
		22	1900	7, 189	3.74	268.9
		15	1901	6, 711	3.83	257.2
		11	1902	6, 600	3.87	255.4
		20	1903	6, 305	3.64	229.5
		15	1904	7, 183	3.71	266.5
Average.....				6, 476		260.4
E. M. Barton, Illinois.....	Brown Swiss.....	16	1896	6, 812	4.09	278.6
		20	1897	6, 503	3.64	236.7
		16	1898	7, 813	3.94	307.8
		22	1899	6, 785	3.95	268.0
Average.....				6, 978	3.91	272.8
Levi P. Morton, New York.....	Guernsey.....	62	1892	6, 119.8		
		83	1896	5, 240.0	5.08	266.2
		35	1898	7 689.0	5.73	440.6
		5	1899	7, 561.6	5.24	386.4
Average.....				6, 652.6		364.4
S. Mather & Sons, New York.....	Holstein.....	36	1898	7, 607.1	3.61	274.9
		30	1899	8, 381.0	3.43	287.6
		31	1900	7, 968.7	3.47	276.7
		35	1901	8, 166.6	3.41	278.3
		33	1902	7, 790.0	3.41	265.9
Average.....				7, 982.7	3.47	276.7
A. E. Stevens, Washington.....	Jersey.....	12	1894-5	6, 499.6	4.81	312.6
		11	1895-6	6, 110.0	5.26	321.4
		12	1896-7	6, 323.7	5.58	352.8
		12	1897-8	5, 964.5	5.60	334.0
Average.....				6, 224.4	5.30	320.2

## RECORDS OF SINGLE PUREBRED COWS FOR ONE YEAR.

The value of accurate yearly records of the dairy performance of purebred cows can hardly be overestimated. These records are indispensable in determining the profit of a cow and her value from the breeder's standpoint. The data included in the following table will serve to answer the question frequently asked: "How much product of milk and butter can be expected from cows of the different breeds?" Naturally, with cows representing different families, kept under various conditions of soil and climate and treated very differently as to feed and management, there is a wide variation in the yield.

*Milk and butter-fat records of single purebred cows for one year.*

Breed.	Name of cow.	Age.	Milk yield.	Fat in milk.	Yield of butter fat.
		<i>Years.</i>	<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>
Ayrshire.....	Acelista.....	10	11,277	3.46	390.00
	Rena Myrtle.....		12,172	3.85	468.60
	Acelista.....		10,034	3.65	366.20
	Rose Deross 10347.....		10,645	4.61	490.30
	Lady Fox 9669.....		12,299	4.35	534.90
	Lukolela 12357.....		12,187	3.82	465.40
	Meewee 11130.....		11,252	4.32	486.00
	Xoa 11469.....		10,155	4.01	407.10
	Miss Olga 13984.....		10,096	4.17	420.90
	Princess Aldine 7815.....	10	14,200		
	Bettschard's Laubi 717.....	11	10,750	3.92	421.60
	Julia B. 681.....		8,380	3.72	312.20
Brown Swiss.....	Kaiserin 850.....		10,295	3.89	400.00
	Gelten 712.....		10,741	3.80	408.10
	College Becky 1859.....		10,156	3.85	391.10
	Vesta.....	9	4,038		
Devon.....	Lisa.....	7	4,652		
	Zoe.....	7	4,097		
		5	6,013		
Guernsey.....	Lady Alice.....		9,038	4.28	388.30
	Yeksa Sunbeam 15439.....	9½	14,921	5.74	857.15
	Imp. Pretoria 14443.....	4½	11,529	5.30	595.35
	Portia of Maplehurst 10071.....	4	11,623	5.29	602.37
	Vestella of Belle Vernon 12500.....	3¾	10,064	5.53	550.21
	Dolly Bloom 12770.....	3½	12,675	5.01	623.94
	Sister Sue of Mossiel 17480.....	2½	10,622	5.53	582.37
	Imp. Itchen Daisy 3d 15630.....	2	9,959	5.39	533.83
	Aaggie 2d.....	5½	20,763		
	Princess of Wayne.....	12	29,009		
Holstein.....	Clothilde.....	6½	26,052		
	Clothilde 2d.....	4½	23,603		
	Boutje.....	7½	21,679		
	Pietertje 2d.....	9½	30,318		
	Belle Sarcastic 23039.....		23,190	3.11	721.68
	Houwtje D. 12005.....		19,025	3.47	660.20
	Johanna 5th Clothilde.....	6	16,452	3.83	630.02
	Lilith Pauline De Kol 43434.....	5	19,061	3.24	617.36
	Beryl Wayne 32496.....	7	17,166	3.50	600.77
	Oneida 2d.....		10,171	5.53	562.71
Jersey.....	Merry Maiden.....		10,488	5.61	588.51
	Sophona.....		9,060	6.05	548.47
	Oonan 11th.....	4½	9,138	5.46	498.07
	Tonona 9th.....	2½	8,034	5.63	452.43
	Oonan 25th.....	3½	8,274	5.38	445.38
	Tonona 12th.....	2	7,990	5.33	425.96
	Sophie 10th.....	6½	8,683	5.51	478.62
	Oneida.....		12,735	4.37	556.10
	Kathletta's Fancy.....		11,784	4.94	581.79
	Miss Helen Brice.....		10,980	5.02	550.79
	Ida of Glendale.....	6	13,475	4.71	634.38
	Edith's Faith.....	10	8,254	7.03	579.91
	Dots Lily.....		9,460	6.10	577.00
	Nera N-5 3505.....		12,204	3.85	469.80
Red Polled.....	Duchess of Wis 5.....		11,015	3.90	429.58
	Ruby Twin.....	1	10,239	5.18	530.40
	Mayflower 2d.....		10,458	4.47	468.00
	Susie.....		11,023	6.83	422.60
Shorthorn.....	Mamie Clay 2d.....		10,315		
	Maud.....		10,100	4.15	419.00
	Lady Knightly 15th.....		9,711	3.59	348.60
	Pansy of Stanton 35th.....		10,055	3.89	391.10
	College Moore.....		8,450	4.13	349.20
	Reward of Nora's Duke.....		9,327	4.13	385.10

It is of interest to note the uniformly good records of certain families of cows—for example, the Johanna family of Holsteins, given below. The old adage “like produces like” is demonstrated here. Dairymen who have unusually good cows should make the most of them in building up a herd of large producers, and should consider carefully their value when tempting offers are made. Many a dairyman's success in building up a good herd is due to one or two extraordinary cows which were his foundation stock.



FIG. 7.—Purebred Guernsey cow Yeksa Sunbeam 15439 Adv. R. 331. Official year's record, 14920 lbs. milk, containing 857.15 lbs. butter fat, equal to 1,000 lbs. butter.

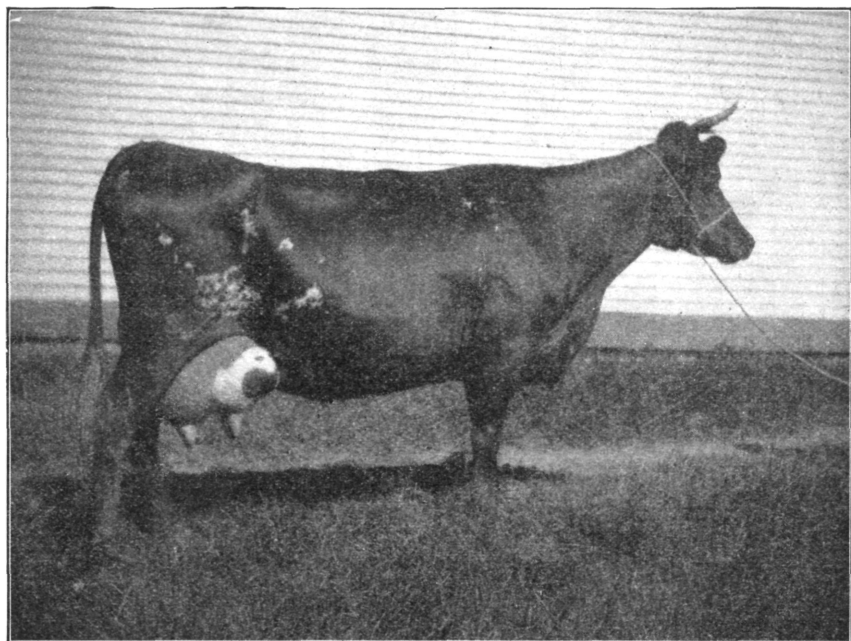


FIG. 8.—Purebred Ayrshire cow Miss Ollie 12039. Best year's record, 9,924 lbs. milk, 440.6 lbs. butter fat, 4.44 average per cent of fat; best month's record, 77.2 lbs. butter fat; best week's record, 364.2 lbs. milk, 15.3 lbs. butter fat, 4.2 average per cent of fat; best day's record, 56 lbs. milk, 2.57 lbs. butter fat, 4.59 average per cent of fat. Average for 6 years, 8,168 lbs. milk, 355.4 lbs. butter fat, 4.35 average per cent of fat.

*Milk and butter-fat records of single purebred Holstein cows of the Johanna family for one year.*

Owner.	Name of cow.	Age.	Time in milk.	Milk yield.	Average fat in milk.	Butter fat yield.
Gillet & Son, Wisconsin.....	Johanna Rue.....	Yrs. 8	Mos. 12	Lbs. 20,340.4	Per ct. 3.46	Lbs. 704.00
	Johanna Rue 2d.....	6	12	18,288.9	3.62	662.70
	Johanna 5th Clothilde.....	6	12	16,452.1	3.83	630.02
	Johanna De Kol.....	4	10	13,760.4	3.73	513.30
	Johanna Aaggie.....	4	11	16,102.1	3.81	613.00
	Johanna De Kol 2d.....	2	10½	11,944.4	3.67	438.40
	Johanna de Pauline.....	2	10½	11,058.7	3.74	413.60
	Duchess Clothilde.....	5	12	16,499.8	3.40	560.90
	Colantha 4th.....	3	11½	14,951.5	3.86	577.20
	Johanna 4th.....	10	12	14,946.5	3.50	523.12
	Johanna 5th.....	4	12	16,186.3	.....	.....
	Johanna May.....	6	10	12,176.7	.....	.....
	Johanna Clothilde.....	4	11½	13,467.0	4.08	549.50
	Johanna Rue 3d.....	3	12	15,416.4	3.61	556.50
	Johanna Rue 4th.....	2	10½	11,285.6	3.49	394.00
	Johanna De Kol 3d.....	2	12	10,675.1	3.59	383.40
	Johanna Ruth.....	2	12	12,178.0	3.95	481.00
	Johanna de Colantha.....	2	12	12,787.0	3.88	496.10
	Johanna Colantha.....	4	12	13,428.8	3.82	512.90
	Colantha 4th's Johanna.....	4	12	19,309.3	3.59	693.20

RECORDS OF SINGLE PUREBRED COWS FOR SERIES OF YEARS.

These records give examples of persistency in milk production and show that a cow's period of usefulness may extend over eight or ten years and even longer.

*Milk and butter-fat records of single purebred cows for series of years.*

Owner.	Breed.	Name of cow.	Age.	Year.	Time in milk.	Yield of milk.	Fat in milk.	Yield of butter fat.
L. S. Drew, Vermont.	Ayrshire.....	Sheba 11931.....	Yrs. 2	1894	Days. 130	Lbs. 2,324.00	P. ct. 4.35	Lbs. 101.10
		.....do.....	3	1895	360	5,809.00	5.00	290.50
		.....do.....	4	1896	300	6,121.00	5.14	314.60
		.....do.....	5	1897	247	7,117.00	4.43	315.30
		.....do.....	6	1898	290	6,973.00	4.11	286.60
		.....do.....	7	1899	304	9,043.00	4.11	371.70
		.....do.....	8	1900	304	7,812.00	4.15	324.20
		.....do.....	9	1901	291	7,733.00	4.02	310.90
		.....do.....	10	1902	289	6,025.00	3.27	197.10
		.....do.....	11	1903	272	5,477.00	3.93	215.10
		.....do.....	12	1904	254	5,440.00	3.95	215.10
		Average.....	.....	.....	.....	6,352.00	4.21	267.50
		.....do.....	7	1894-95	345	7,831.00	3.90	305.50
		.....do.....	8	1895-96	293	6,068.00	4.06	246.60
		.....do.....	9	1896-97	356	8,782.00	4.06	356.80
		.....do.....	10	1897-98	268	7,662.00	3.80	291.00
		.....do.....	11	1898-99	333	8,344.00	4.00	333.80
		.....do.....	12	{ 1899 1900 }	317	7,776.00	3.75	291.60
		.....do.....	13	{ 1900 1901 }	339	9,161.00	3.74	342.30
		.....do.....	14	1901-2	288	5,692.00	3.71	211.10
		.....do.....	15	1902-3	317	5,610.00	3.81	213.80
		Average.....	.....	.....	.....	7,436.00	3.87	288.10
C. M. Winslow, Vermont.	.....do.....	Acelista.....	6	1900	.....	9,354.00	3.58	335.20
		.....do.....	7	1901	.....	9,330.00	3.76	350.60
		.....do.....	8	1902	.....	9,090.00	3.64	330.80
		.....do.....	9	1903	.....	9,843.00	3.38	332.60
		.....do.....	10	1904	.....	11,268.00	3.53	397.80
		Average.....	.....	.....	.....	9,777.00	3.57	349.40

## Milk and butter-fat records of single purebred cows for series of years—Continued.

Owner.	Breed.	Name of cow.	Age.	Year.	Time in milk.	Yield of milk.	Fat in milk.	Yield of but- ter fat.
			<i>Yrs.</i>		<i>Days.</i>	<i>Lbs.</i>	<i>P. ct.</i>	<i>Lbs.</i>
E. M. Barton, Illi- nois.	Brown Swiss.	Flawyl .....	7	1896	.....	9,067.00	4.10	371.30
		do. ....	8	1897	.....	6,936.00	3.77	261.60
		do. ....	9	1898	.....	9,207.00	3.72	342.70
		Average .....			.....	8,403.30	3.87	325.20
	do. ....	Bettschard's Laubi.	9	1896	.....	7,114.00	4.21	299.80
		do. ....	10	1897	.....	6,605.00	3.94	260.20
		do. ....	11	1898	.....	10,750.00	3.92	421.60
		Average .....			.....	8,156.30	4.01	327.20
E. W. Strawbridge, New Jersey.	Guernsey ....	Auricula 2d.			.....	8,194.00	.....	.....
		do. ....	4	1901-2	.....	10,070.00	.....	.....
		do. ....	5	1902-3	.....	12,077.00	.....	.....
		do. ....	6	1903-4	.....	12,654.20	4.40	555.60
		do. ....	7	1904-5	.....	13,411.60	4.51	605.50
		Average .....			.....	11,281.20	.....	.....
C. L. Hill, Wiscon- sin.	do. ....	Lady Bishop .....	5	1896	.....	5,555.30	5.11	284.00
		do. ....	6	1897	.....	6,346.20	5.40	342.50
		do. ....	7	1898	.....	6,823.20	5.43	370.80
		do. ....	8	1899	.....	7,064.00	5.85	413.20
		do. ....	9	1900	.....	6,157.10	5.28	325.10
		Average .....			.....	6,389.20	5.43	347.10
New Jersey Experi- ment Station.	Holstein .....	Hilda .....		1898	.....	6,588.10	4.20	273.74
		do. ....		1900	.....	7,172.40	3.80	270.25
		do. ....		1901	.....	10,119.20	3.80	387.83
		do. ....		1902	.....	9,782.00	3.75	366.37
		do. ....		1903	.....	8,511.30	3.50	298.81
		Average .....			.....	8,434.60	3.78	319.40
Wisconsin Experi- ment Station.	do. ....	Alma .....		1899	.....	9,102.60	3.22	292.93
		do. ....		1900	.....	10,811.40	3.34	360.57
		do. ....		1901	.....	10,732.20	3.15	432.98
		do. ....		1902	.....	10,195.00	3.08	313.66
		Average .....			.....	10,960.30	3.19	350.03
Minnesota Experi- ment Station.	Jersey .....	Champion's Sweet Brier 3d.		1892	.....	7,057.00	5.10	359.90
		do. ....		1893	.....	7,094.00	5.00	354.70
		do. ....		1894	.....	4,744.00	4.90	232.50
		do. ....		1895	.....	8,426.00	4.98	419.60
		do. ....		1896	.....	6,364.00	5.00	318.20
		do. ....		1897	.....	7,594.00	5.35	406.20
		Average .....			.....	6,879.80	5.07	348.50
					.....			
Vermont Experi- ment Station.	do. ....	Minta Bella 85578...	4	1895-96	285	4,726.00	6.25	295.30
		do. ....	5	1896-97	365	5,751.00	6.70	385.50
		do. ....	6	1897-98	325	6,036.00	5.54	334.20
		do. ....	7	1898-99	363	4,953.00	6.60	326.70
		do. ....	8	1899	344	6,860.00	5.72	392.20
		do. ....	9	1900	309	6,162.00	5.62	346.40
		do. ....	10	1901-2	314	5,468.00	5.58	304.90
		do. ....	11	1902-3	321	6,200.00	5.66	351.00
		Average .....			.....	5,769.50	5.93	342.00
					.....			
George H. Sweet, New York.	do. ....	Pride's Olga 4th 96870.	4	1897-98	284	9,509.60	.....	.....
		do. ....	5	1898-99	290	10,698.70	.....	.....
		do. ....	6	1899	330	11,888.30	.....	.....
		do. ....	7	1900	223	6,677.90	.....	.....
		do. ....	8	1901-2	248	9,791.00	.....	.....
		do. ....			.....			



*Milk and butter-fat records of single purebred cows for series of years—Continued.*

Owner.	Breed.	Name of cow.	Age.	Year.	Time in milk.	Yield of milk.	Fat in milk.	Yield of butter fat.
George H. Sweet, New York.	Jersey .....	Pride's Olga 4th 96870.	Yrs. 9	1902-3	Days.	Lbs.	P. ct.	Lbs.
		.....do.....	10	1903-4	.....	10,185.30	.....	.....
		.....do.....	11	1904-5	223	9,759.10	.....	.....
		.....do.....	.....	.....	.....	8,095.70	.....	.....
		Average.....	.....	.....	.....	9,575.70	.....	.....
J. K. Innes, New York.	Shorthorn....	Jennie Lee.....	.....	1902-3	336	8,153.90	.....	.....
		.....do.....	.....	1903-4	304	8,758.60	.....	.....
		.....do.....	.....	1904	115	4,610.30	.....	.....
		Average.....	.....	.....	.....	7,174.27	.....	.....
		.....do.....	.....	.....	.....	.....	.....	.....
Utah Experiment Station.	.....do.....	No. 1.....	4	1894-95	334	5,159.00	3.04	156.70
		.....do.....	5	1895-96	280	4,501.00	3.06	137.70
		.....do.....	6	1896-97	322	7,228.00	3.35	242.30
		.....do.....	7	1897-98	291	6,309.00	3.14	198.00
		.....do.....	8	1898-99	214	5,870.00	3.35	196.70
		Average.....	.....	.....	.....	5,813.40	3.20	186.28

## SOME REMARKABLE LONG-PERIOD RECORDS.

A purebred Ayrshire cow, Crocus No. 3400, owned in Portsmouth, N. H., made an average milk record for twelve years of 7,082 pounds and for fifteen years of a little over 6,000 pounds. She lived until 17 years of age, and her total milk product amounted to over 45 tons, or 5,000 Boston cans of 8½ quarts each.

Another purebred Ayrshire cow, Annie Bert, owned at Hickory Hill Farm, New Hampshire, gave in twelve years 90,389 pounds (over 45 tons) of milk and 3,906 pounds of butter.

A proprietor of a dairy farm in New York makes the following statement regarding the dairy performance of a Jersey cow in his herd, Pride's Olga 4th:

The total number of days she has milked since she dropped her first calf has been 2,257, and the total amount of milk given in that time has been 76,605.64 pounds, which means an average of 33.94 pounds of milk per day.

A New Jersey dairyman gives the following statement regarding the dairy performance of a purebred Holstein cow owned by him:

Quite a remarkable cow in our herd is Susie De Kol, a registered Holstein-Friesian cow, and possibly one of the strongest bred in the De Kol lines of any cow living at the present time. She has given birth to ten calves—seven heifers and three bulls—all of which are living. She came to Bloomingdale after her second calf, and has been in milk here seven years, and during that time she has given 81,284 pounds of milk, or 40 tons and 1,284 pounds, equal to about 36,475 quarts, which at an average price of 3 cents per quart would give \$1,093.25. She has been officially tested three times. In 1899 she gave 19.84 pounds butter in seven days; in 1900 she gave 24.31 pounds butter; in 1901 she gave 474.48 pounds milk and 25.3 pounds butter, her milk averaging 4.26 per cent fat during the test. She has five daughters and several granddaughters that have advanced registry records.

The University of Missouri reports that a registered Jersey cow, Hope of Ramapo, at that institution, brought \$1,341.72 into the school treasury during seventeen years through the sale of her butter, milk, and calves. Her record for this period is 78,585 pounds of milk, 4,147 pounds of butter, and 15 calves.

Such records as the above show the possibilities of production from a good cow. Many farmers who keep a cow a year to raise a \$15 or \$20 calf think they have done well, but such profits do not compare with those of the dairyman.

#### RECORDS OF PUREBRED COWS FOR SHORT PERIODS.

The records of purebred cows for short periods presented in the accompanying table will serve to show the possibilities of production when animals are carefully bred and fed and managed with the view of securing maximum yields.

#### *Milk and butter-fat records of purebred cows for short periods.*

Breed.	Name of cow.	Age.	Time.	Yield of milk.	Fat in milk.	Yield of butter fat.
		<i>Years.</i>	<i>Days.</i>	<i>Pounds.</i>	<i>Per cent.</i>	<i>Pounds.</i>
Ayrshire.....	Miss Ollie.....	1	1	54.96	4.70	2.58
	Mary 2d.....	1	1	70.00		
	Miss Olga 13984.....	4	7	333.50	4.30	14.34
	Lukolela 12357.....	6	7	428.50	3.80	16.28
Brown Swiss.....	Annie Bert 9670.....	7	7	333.20	4.20	13.99
	Brienzi 168.....	3	3	245.10	3.81	9.33
	Bettschard's Laubi.....	12	1	56.80	4.27	2.43
	do.....	12	7	361.00	3.92	14.15
Devon.....	Songstress 2d.....	6	1	51.00	4.00	2.04
	Lady Alice.....	7	7	347.00	4.00	13.88
Guernsey.....	Queen Deette 9794.....	4½	7	413.10		16.22
	Imp. Princess Rhea 15479.....	7½	7	349.10		16.06
	Mentor Maid 13261.....	4	7	299.90		16.02
	Cecchina 11694.....	4	7	300.40		13.52
Holstein.....	Pieterje 2d 3273.....	9½	1	112.40		
	Princess of Wayne.....	11½	1	113.10		
	Gelsche 173.....	7	1	100.00		
	Rosa Bonheur 5th 11227.....	1	1	106.00	2.89	3.66
	Aaggie Cornicopia Pauline 48426.....	2½	1	86.00		
	Lilith Pauline De Kol 43434.....	4	1	100.85		
Jersey.....	Emma's Pearl.....	1	1	53.50		
	Effie of Jefferson.....	1	1	56.00		
	Pride's Olga 4th.....	1	1	65.30		
	Countess Matilda.....	6½	7	270.20	6.28	16.96
	Figgis 76106.....	11	7	293.40	5.49	16.10
	Bluster's Pip.....	6½	7	307.40	5.21	16.02
Red Polled.....	Betsona's Khedive le Gros.....	10½	7	282.00	5.50	15.51
	Chloe.....	8	7	201.70		8.41
	Glee 4927.....	1	1	34.34	4.71	1.62
	Popsey 3d.....	6	1	57.40	3.77	2.16
Shorthorn.....	Average of 7 cows.....	1	1	37.92		1.55
	Lady of Tittleshall.....	1	1	40.84	4.43	1.81
	College Moore.....	7	7	258.50	4.51	11.66
	Kitty Clay 4th.....	30	30	1,592.90	3.34	53.31
	Kitty Clay 3d.....	30	30	1,230.60	3.49	43.03
	Reward of Nora's Duke.....	30	30	1,145.50	3.97	45.51

#### RECORDS OF TWO NOTED DAIRY COWS.

The purebred Holstein cow Shadybrook Gerben (fig. 9) was the leader for all breeds at the St. Louis dairy contest (1904) in total production of milk and butter fat. She was but twelve days in milk

when the test began. During the one hundred and twenty days she produced 8,101.7 pounds of milk, containing 282.601 pounds of fat and 620.534 pounds of solids not fat. The estimated butter yield was 330.361 pounds. The percentage of fat in the milk of Shadybrook Gerben was 3.48 and of solids not fat 7.65; the percentage of total solids 11.13. Her grain ration averaged 22.1 pounds a day, and the hay and other coarse feed 64.22 pounds a day. The average cost of her feed per day was 30.47 cents. Her milk yield averaged 67.5 pounds a day for the whole period of the test, she having started with a yield of 80 pounds a day. Her fat yield averaged 2.355 pounds a

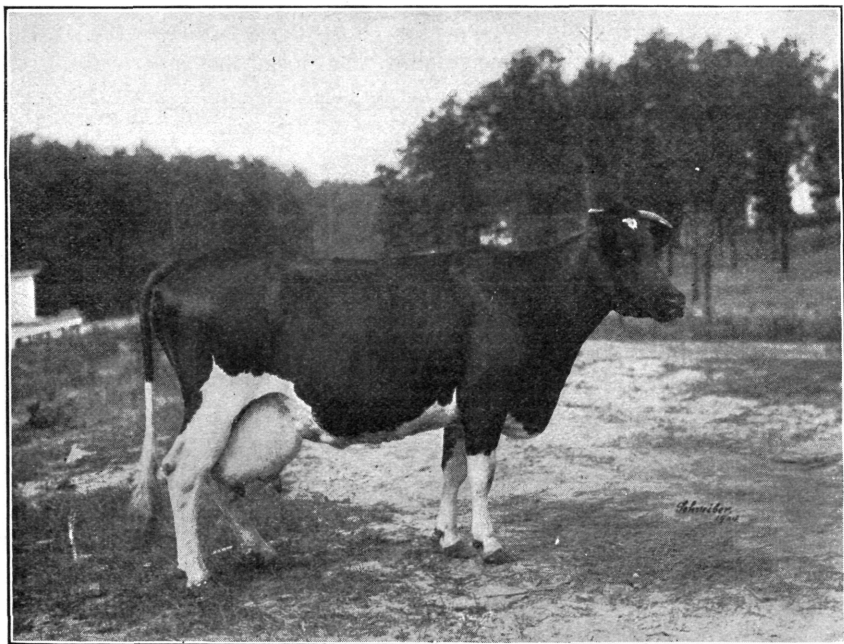


FIG. 9.—Purebred Holstein cow Shadybrook Gerben 43753. Leading Holstein cow in World's Fair dairy demonstration, St. Louis, 1904. Record for 120 days, 8,101.7 lbs. milk, 282.601 lbs. butter fat. 3.5 per cent butter fat.

day, and her butter yield 2.753 pounds. It required 24.52 pounds of her milk to make 1 pound of butter. The cost of feed in 1 pound of butter was 11.07 cents.

The purebred Jersey cow Loretta D. (fig. 10) is a cow of exceedingly strong constitution and weighs 998 pounds. She is owned by the W. S. Ladd estate, Oregon. She was the leader in the dairy-cow demonstration at the Louisiana Purchase Exposition for demonstrating the economic production of milk and butter fat. At the beginning of the test she was 7 years and 8 months old, and had been seventy-one days in milk. During the one hundred and

twenty days of the test she produced 5,802.7 pounds of milk, containing 280.161 pounds of butter fat and 522.895 pounds of solids not fat. The fat was officially estimated to equal 330.03 pounds of butter. From the date of her freshening to the end of the St. Louis test, April 10 to October 13, 1904 (one hundred and eighty-one days), she produced 9,214.7 pounds of milk, containing 416.64 pounds of fat, or a daily average of 49.3 pounds of milk, 2.23 pounds of fat, and 2.62 pounds of butter. The milk of this cow during the St. Louis test contained on the average 4.82 per cent of fat and 9.01 per cent of other solids, making the per cent of total solids 13.83. She was fed an average of 17.49 pounds of grain and 36.93 pounds of hay

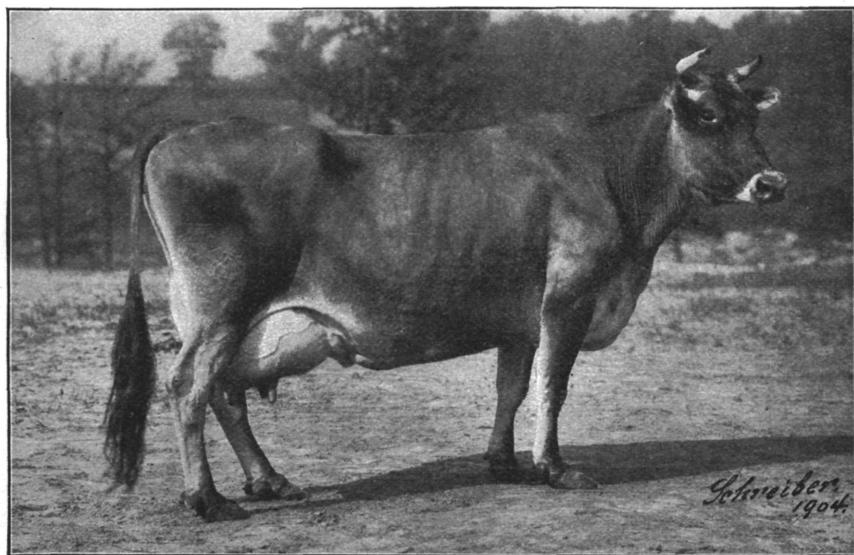


FIG. 10.—Purebred Jersey cow Loretta D 141708. Champion cow in classes A and B, World's Fair dairy demonstration, St. Louis, 1904. Record for 120 days, 5,802.7 lbs. milk, 4.8 per cent fat, 330.03 lbs. estimated butter.

and silage per day at a cost of 26.65 cents a day. It required 17.58 pounds of her milk to make an estimated pound of butter. She averaged in butter value 68.75 cents a day and in net profit for production of butter 42.09 cents per day. She averaged in milk value 83.11 cents per day and in net profit for production of milk 56.45 cents per day. In March, 1902, when 5 years and 5 months old, she was put on a fat test for one year, during which she produced 9,241.1 pounds of milk, containing 516 pounds fat, verified by a representative of the Wisconsin Experiment Station. She has an official seven-day record of 17.24 pounds of butter fat.

## CONCLUSIONS.

The discussions presented in the preceding pages may be briefly summarized as follows:

The scales and the Babcock test are essential requisites for every true dairyman.

One dairyman's cows may produce twice the yield and return double the profit of those of another with the same soil and the same market, simply because he uses greater intelligence in his business.

Records are valuable because they assist dairymen to distinguish the good from the poor cows, assist the feeder in preparing rations economically, give warning of the approach of sickness, and give inspiration to those who watch carefully for improvement.

Accurate and continuous records are necessary for best results. Examples show the impracticability of trying to determine the profitable cows by mere guesswork. One dairyman found the cow he had picked out for best to be fifth on his merit list when actual records were taken.

It is desirable that records of dairy animals include not only the dairy performance, but a concise history and description of each animal, and a record, at least of approximate accuracy, of the cost of the feed of every cow, so that the economy of production may be determined.

The time and expense required in keeping records is small compared with their value. In some instances one minute to a cow at each milking, or two minutes a day, has been found sufficient to record the weight of the milk and take the sample. On this basis, when milk is weighed and tested every seventh week, as is customary with some dairymen, only about one hour and thirty-eight minutes would be required yearly for each cow tested. With this amount of time expended a reasonably accurate record can be secured of every cow in the herd.

While daily records are best, various investigators have recommended methods of estimating the yearly production from a few weighings and tests, a number of which have proved practical and reasonably accurate. For example: The Wisconsin station recommends weighing and sampling the milk one day each week during the year; the Illinois station suggests weighing and sampling each cow's milk for fourteen consecutive milkings every seventh week; the Vermont station recommends that when only two tests of each cow's milk are to be made during the same lactation period in case of fall-fresh cows, the first test should be made eight to ten weeks after calving and the second test five and one-half to seven months; the Maryland station decides, after an exhaustive study of this question, that the seventh month in the lactation period would be the

best to test the cow when only one test a year is made; when combinations of two tests are to be made at different periods, this station found that the third and eighth months would be best, and for a combination of tests during three months, the third, sixth, and eighth.

The average production of the dairy cows in the country is hardly up to the profit line. The average yield per cow in the year 1900 was reported to be 3,646 pounds of milk and 155 pounds of butter. Every dairyman should determine upon a standard for his herd which will yield him a good profit and work up to it by keeping a record of the quantity and quality of the milk product and the cost of production, and by systematically weeding out the herd. Examples are numerous where dairymen are doing this successfully.

The answers to 600 circulars sent to dairymen indicated that only a very small proportion made any attempt to keep records of their cows. Of the 200 replies received, 25 per cent stated that they did not keep records, and it is believed that a large proportion of the 400 who did not respond had no records to offer. A still smaller proportion was able to give the cost of keeping their cows.

Reports from dairymen as to the kind of cows kept indicated that where they selected a special breed they were more careful in the breeding and management of their cows and secured larger yields and greater profits than where there was a mixture and no single breed predominated.

Dairymen who were careful to supply an abundance of nutrients to their cows, even though they had to buy concentrated feeding stuffs to balance the ration, received the greatest profit for money expended for feed. Occasionally a farmer who raised such crops as clover, alfalfa, field peas, and cowpeas was able to balance his ration without the purchase of protein feeds.

Too often the carbohydrates in the rations were far in excess of what the cow could utilize in milk production, and this resulted in waste. In some cases cornstalks were fed to the stock dry and uncut, only a part being eaten. Where protein crops were grown to supplement the pasture, an increased milk yield and greater profit were secured. It was also shown that the silo assisted materially in reducing the cost of feed.

In some instances low records were due in part to the barns not being sufficiently warm, this resulting in a waste of nutrients. Too often dairymen provided no system of ventilation other than windows, holes in the floor over the stables, and hay chutes. Sunshine as well as pure air was frequently lacking. These conditions all have their influence upon milk production.

Good dairymen as well as poor ones seem to be in clusters. The influence of a few progressive dairymen who study their business

and become intelligent in regard to it is shown in some communities. In others the example of those who do not read and study dairy methods is followed, and they are all ignorant together, and as a result they receive very little, if any, profit from their cows.

One reason for low records and lack of progress is that many dairymen do not avail themselves of the education in dairying and agriculture so cheaply offered to them by the dairy and agricultural papers, farmers' institutes, farmers' reading courses, experiment stations, agricultural colleges, etc. It has been clearly demonstrated that dairymen must get above average methods and average conditions to attain success, and must use business methods and avail themselves of the latest and best knowledge.

Cows producing good records are not confined to any one breed or locality or section of the country. The individuality of the cow and the care and treatment she receives have more influence than natural conditions or peculiar characteristics of the soil.

A cow's dairy performance can not be fairly judged from her record for a single year. Dairy cows have their "off years," and this must be considered when cows having poor records are being dropped from the herd. If this fact is not borne in mind, there is danger of selling the best cows.

Cows producing 5,000 pounds of milk and 200 pounds of butter annually are within the reach of every painstaking dairyman. A lower yield than this in most sections of the country leaves little or no margin for profit. It should be the constant aim of the dairyman to raise his standard.

Many dairymen make the mistake of keeping more cows than they can properly shelter and feed. It is more profitable to begin with a few well cared for than with a large number poorly fed and poorly sheltered. As a rule dairymen have cows enough in number, but their yield is too low. To increase the profit the product must be increased.

The fundamental steps to be taken in improving dairy herds may be stated as follows:

1. Take advantage of variation. While the tendency of nearly all cows raised is to become average cows, a number fall below and a few reach a yield of 500, 600, or even 700 pounds of butter.

2. Those above the average should be carefully selected and bred with care and judgment.

3. While the test must be used to detect variation and make selections, it is needed particularly to test the progeny, to determine whether the good qualities of the parent have been perpetuated, and to see if any improvement in the offspring has been made.

4. Feed, care, and management are of the highest importance. Having been carefully selected and having stood the test, the cows must be well fed and cared for if their good qualities are to be retained and improved.